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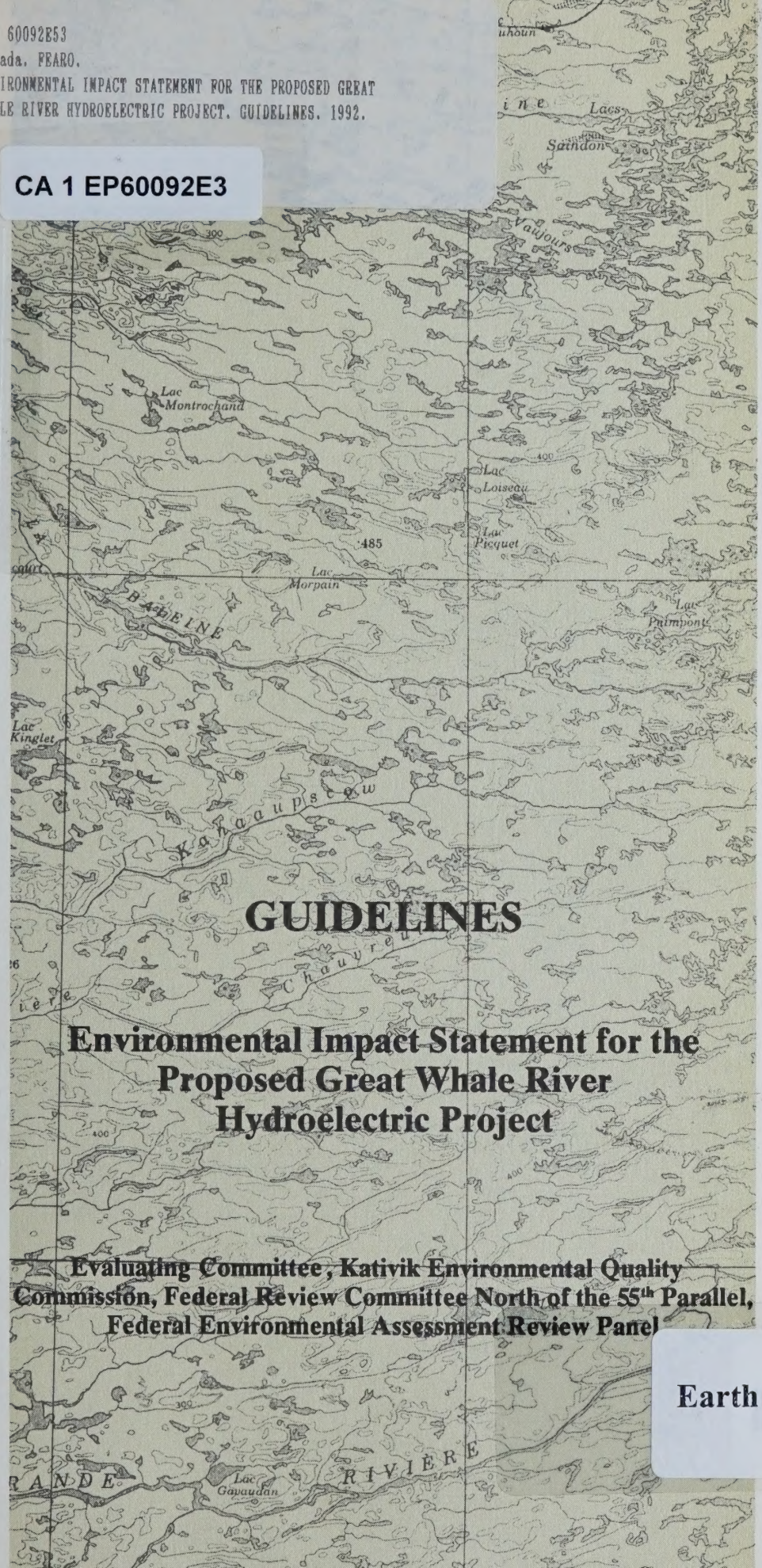

GUIDELINES

Environmental Impact Statement for the Proposed Great Whale River Hydroelectric Project

Evaluating Committee, Kativik Environmental Quality Commission, Federal Review Committee North of the 55th Parallel, Federal Environmental Assessment Review Panel

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Environmental Impact Statement for the Proposed Great Whale River Hydroelectric Project

Evaluating Committee, Kativik Environmental Quality Commission, Federal Review Committee North of the 55th Parallel, Federal Environmental Assessment Review Panel

Publication and Distribution:

Great Whale Public Review Support Office
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All briefs submitted during the public scoping hearings are available at the Great Whale Public Review Support Office. Transcripts of the hearings are also available, as are written comments received from the public concerning the Draft Guidelines.

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August 28th, 1992

Mr. Pierre Paradis
Minister of the environment
3900, Marly Street, 6th floor
Ste-Foy (Québec)
G1X 4E4

Mr. Michel Dorais
Federal Administrator
200, Sacré-Coeur blvd
13th floor, Fontaine Building
Hull (Québec)
K1A 0H3

Sirs:

On behalf of the members of the Evaluating Committee, of the Kativik Environment Quality Commission, and of the Federal Review Committee North of the 55th Parallel, we are forwarding to you the Guidelines for the Environmental Impact Statement for the Proposed Great Whale River Hydroelectric Project.

These Guidelines are based on the application of sections 22 and 23 of the James Bay and Northern Quebec Agreement, Chapter II of the Environmental Quality Act and the Federal Environmental Assessment and Review Process Guidelines Order.

In accordance with the letter and the spirit of the Memorandum of Understanding signed on January 23, 1992 by the concerned parties, these review bodies have coordinated and harmonized their work through the Great Whale Public Review Support Office.

These Guidelines are the result of a constant effort of harmonization between the Commissions and Committees. We invite you to follow the same approach in the establishment of a process by which the Proponent can seek clarifications on questions which, in his opinion, need to be clarified.

We wish to thank all the organizations and people who have participated to the public scoping process and those that have submitted written comments. Their contribution has been very constructive.

Yours very truly

Chief Billy Diamond
President
Evaluating Committee

Peter Jacobs
President
Kativik Environment
Quality Commission

Paul Lacoste o.c.
President
Federal Review
Committee North of the
55th Parallel

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CHAPTER 1

INTRODUCTION

101. These guidelines are issued for the preparation by the Proponent, Hydro-Québec, of an Environmental Impact Statement (EIS) for the proposed Great Whale River hydroelectric project. "Environment" is meant to include both the biophysical and social milieu. The expression "Environmental Impact Study" is therefore equivalent to the expression "Environmental and Social Impact Statement" as mentioned in the *James Bay and Northern Quebec Agreement* (JBNQA).

102. These guidelines have been prepared by four environmental assessment review bodies – the Evaluating Committee, the Kativik Environmental Quality Commission, the Federal Review Committee North of the 55th Parallel and the Federal Environmental Assessment Review Panel. Each of them has the mandate to issue guidelines for the EIS of the proposed Great Whale River hydroelectric project. However, these bodies, while working independently, have coordinated and harmonized their efforts in accordance with the *Memorandum of Understanding* (MOU) signed on January 23, 1992 (Appendix 1).

103. In accordance with Sections 22 and 23 of the JBNQA, Chapter II of the *Environment Quality Act* and the federal *Environmental Assessment and Review Process Guidelines Order*, the Proponent must produce an EIS in conformity with these guidelines. The MOU confirms this requirement. The EIS must comply with all the provisions of the *Regulation Respecting Environmental and Social Impact Assessment and Review Procedure Applicable to the Territory of James Bay and Northern Quebec* (c.Q-2, r.11), as well as all other applicable laws and regulations.

104. These guidelines include all questions addressed to the Proponent by the bodies listed above. They also incorporate other issues that were raised during public consultations, as well as in the aforementioned MOU. Each review body will, in its report, recommendation or decision, address those matters that fall within its jurisdiction.

105. The Provincial Review Committee, the Kativik Environmental Quality Commission, the Federal Review Committee North of the 55th

Parallel, the Federal Review Committee South of the 55th Parallel and the Federal Environmental Assessment Review Panel will evaluate whether the EIS is complete and in conformity with these guidelines. Following public hearings, the review bodies will determine the acceptability of the proposed project, and if it is found to be acceptable, under what conditions. These decisions or recommendations shall be transmitted either to the administrators or directly to the appropriate agencies, according to the mandate of the respective bodies.

PURPOSE OF THE GUIDELINES AND PROJECT DEFINITION

106. The purpose of this document is to set forth guidelines that the Proponent must follow in presenting the EIS on the proposed Great Whale River hydroelectric project. It is incumbent upon the Proponent to prepare a complete EIS that includes sufficient basic data and analyses for a complete assessment of the anticipated impacts and their repercussions.

107. These Guidelines pertain to the proposed project as described in the *Preliminary Information* submitted by the Proponent in October 1991. Additional information contained in the Proponent's *Bulletin 5* (November 1991) and in a letter from the Proponent dated February 21, 1992 are considered part of the preliminary information for the purposes of these Guidelines. These documents are reproduced in Appendix 2.

108. The proposed project includes the Great Whale hydroelectric installations, the transportation, housing and communication infrastructures and the corridor of the 315-kV collector system needed to transport electricity to the existing distribution system of the La Grande complex at Radisson and Chissibi substations. Any transmission lines beyond that point are expressly excluded from this review process in conformity with the MOU, which defines the project making reference to the out-of-court Declaration of Settlement in the case of *Dick et al. vs. Paradis et al.* (October 25, 1991). The transportation infrastructure includes all airports required for the proposed project, including any expansion of the existing airport at Kuujjuarapik/Whapmagoostui or the development of any new airport facilities closer to the proposed GB1 site, as well as temporary airports (including the one proposed for Lac Fagnant), road right-of-ways and corridors reserved for this purpose. The transportation infrastructure also includes any existing or planned marine installations which might be required.

109. The variant that has been selected by the Proponent includes the downstream diversion of the Little Whale River, but leaves intact this river's headwaters and middle reaches, and excludes even the partial development of the Nastapoka River basin. Therefore, for the purposes of this EIS, the proposed Great Whale River hydroelectric project includes the combined development of the Little Whale River and the Great Whale River, but completely excludes the development of the Nastapoka River basin.

110. A schedule shall be presented for each phase of construction. It was stated in *Bulletin 5* that the proposed project would be completed between 1993 and 2000. However, at a meeting with the Proponent on April 8, 1992, the review bodies were informed that a new schedule had been adopted whereby GB1 would be commissioned in 2000, GB2 in 2007 and GB3 in 2008. This schedule shall be considered definitive for the purposes of the EIS. Any appreciable change to this schedule should be indicated to the administrators. In that case, the administrators and the review bodies could reconsider the review process. However, the Proponent shall not be considered responsible for any delays due to the public review process.

PRINCIPAL ASSESSMENT CRITERIA

111. The proposed Great Whale hydroelectric development project would take place in an intercultural context in a northern environment; at the same time, it represents a choice with respect to the Government of Quebec's energy policy. The environmental impact assessment of the proposed project, whether in biophysical or social terms, must rely on the principles set forth in Sections 22.2.4 and 23.2.4 of the JBNQA, as well as several other principles that are in turn based on the concept of sustainable and equitable development.

112. In its 1989 *Development Plan*, the Proponent explicitly adopted the concept of sustainable development as defined by the World Commission on Environment and Development (the "Brundtland Report"). This commitment signifies that the proposed project must be developed in accordance with the carrying capacities of ecosystem and human societies involved.

113. The proposed project must also respect the rights of local communities to determine their future and their own societal objectives:

the proposed project must not endanger the durability or quality of resources that form the basis of an existing regional economy that functions in accordance with the precepts of sustainable development. Consequently, one of the elements of the evaluation of the proposed project will be the appraisal of any potentially irreversible impacts upon local and regional economic development.

114. Project evaluation will be based, in part, on respect for the right of future generations to the sustainable use of the ecosystems within the proposed project area, both for the local population and for society as a whole. This involves preserving the region's flora and fauna, maintaining the quality and capacity of ecosystems and their renewable resources, preserving unique and remarkable sites, conserving cultural diversity, and maintaining and improving the quality of life in the region.

PROJECT JUSTIFICATION

115. Before proceeding to an assessment of the proposed project's environmental impacts, the Proponent shall justify the need for the proposed project and explain its general rationale. It is understood, however, that successful justification of the proposed project would not of itself imply project acceptance. Justification is an essential step in the environmental assessment process.

116. The Proponent, in justifying the proposed project, shall address three interrelated aspects of the energy question. The Proponent shall present detailed energy demand growth forecasts for the next 30 years, followed by an examination of all possible alternatives for meeting this anticipated growth in demand. Then, the rationale for choosing the proposed Great Whale project from among the other energy alternatives must also be demonstrated. The MOU contains a list of subjects that must be addressed by the Proponent for each of these analyses.

117. When analysing the most appropriate means of meeting the anticipated growth in demand, the Proponent shall make a qualitative comparison of the major environmental impacts of the various options. This general comparison does not require in-depth studies of each alternative, nor does it replace the technical and economic justification of the proposed project. Rather, it will be taken into account once the direct impacts of the proposed project have been established by means of this EIS.

ENVIRONMENTAL IMPACT STATEMENT

118. In addition to determining the individual impacts on specific elements of the biophysical and social environment, the EIS shall address the combined and cumulative effects of these impacts on entire sectors of the ecosystem, including the human societies in the proposed project area.

119. It is the responsibility of the Proponent to choose the most appropriate analytical methods, taking into account the present guidelines, as well as the environmental and social concerns specific to the cultures of the various populations affected in order to identify as accurately as possible the valued ecosystem components.

120. The Proponent shall determine the extent to which modification of one ecosystem component will be more significant than that of another. The proposed project would have impacts of varying significance, and even minor impacts on a valued ecosystem component may be more significant than major impacts on a secondary component.

121. Evaluation of the proposed project will be based on five fundamental issues that affect ecosystem integrity: 1) the health of all human and animal communities in the region; 2) access to the territory by all human and animal populations; 3) the availability of resources, which requires that they be sufficient in quantity and satisfactory in quality; 4) the maintenance of social cohesion at the local, regional and national levels; and 5) the respect for values.

REGIONAL SCOPE OF THE EIS

122. Some of the potential impacts of the proposed project will occur only in the region defined by the drainage basins and estuaries of the Great Whale River and the Little Whale River, along with Manitounuk Sound and the adjacent coastal areas. Others will extend beyond these boundaries. The communities affected by the proposed project are Whapmagoostui, Chisasibi, Radisson, Kuujjuarapik, Inukjuaq and Umiujaq, as well as the community of Sanikiluaq on the Belcher Islands. The Naskapi may also be affected, as their hunting activities extended to the upper part of the drainage basins of the Great Whale and Little Whale Rivers.

123. The Proponent shall define the appropriate extent of the study area, taking into account the scope of the various components under examination.

124. Some potential impacts of the proposed project have regional and national implications and may affect the entire region of Hudson Bay around which other river development projects have already been built. As well, additional projects are anticipated in this region. The cumulative effects of all of these projects on the influx of sediments, nutrients, heat and contaminants (including mercury) into the Bay, on the regional climate, on the food chain and on the quality and even the survival of the marine resources of Hudson Bay are important environmental concerns. The Proponent shall evaluate the extent to which the proposed project will alter the ecosystem of Hudson Bay. The Proponent shall thus describe the cumulative impacts of this proposed project, considering in particular other projects under its purview, such as the La Grande complex, and other existing projects, such as Churchill-Nelson, and those currently undergoing public review, such as the Conawapa project.

125. Some of the potential impacts of the proposed project have global and international implications that extend well beyond the region directly affected by the project. For example, the Proponent shall address its potential impacts on global climatic conditions through the production of greenhouse gases in areas that would be completely or partially submerged, as well as those on migratory birds, which constitute a biological patrimony shared by other regions and countries. The biological heritage contained in the diversity of the flora and the fauna of the region is another pertinent issue. The Proponent shall demonstrate that the proposed project would not cause irreparable damage to rare or endangered flora and fauna of the region and would not contribute to their extinction.

LOCAL KNOWLEDGE AND VALUES

126. Local residents' knowledge of their biophysical and social milieu is essential to an adequate assessment of the impacts of a development project. Furthermore, each cultural group has its own conceptual and symbolic system that reflects the group's image of itself and of its communities, its environment and its past and future. Since this conceptual and symbolic system partly determines the group's reaction to change, it is an intrinsic element of the environment itself and must be

thoroughly understood before the impacts of a development project can be assessed. In the case of the proposed Great Whale project, the Proponent must be particularly attentive to the conceptual and symbolic systems and knowledge of the populations affected.

127. Considering this diversity of cultures, it is to be expected that the ecosystem components which are identified and given value may well vary from one culture to another, and, even if they are similar, that the reasons for which they are valued may be different. In the same way, since points of view concerning the proposed project and its impacts are based on different values and knowledge, it is quite likely that they will vary from one culture to another. The Proponent shall take this diversity into account both in its description of the environment and in its impact analysis, through the notion of valued ecosystem components.

CONSULTATIONS WITH LOCAL POPULATIONS

128. The reactions of populations to a proposed project, their ability to integrate it into their environment and their propensity to feel alienated by it depend in part on the degree to which they are involved in the decision-making. The Proponent shall therefore establish mechanisms to incorporate the knowledge and opinions of all communities that inhabit the region and plan to continue to do so. These mechanisms shall include consultations related to research that may be required to complete the EIS.

129. The Proponent shall describe the consultation procedures initiated since the announcement of the project, notably those implemented in the affected communities, and the manner in which these consultations have affected the Proponent's decisions with respect to the proposed project.

DATA ACQUISITION METHODOLOGY AND DOCUMENTATION

130. The Proponent shall specify and justify all sampling methods and statistical processes employed in both the biophysical and social milieu. The reliability and scope of the results, the possibility of reproducing the analyses and quality control of laboratory analyses shall be analyzed critically. All data based on environmental sampling necessarily involve some variability, which must be determined to assess the reliability and scope of the data. In the EIS, the Proponent shall, for all data obtained

from environmental sampling, provide a dispersion or variability coefficient (variance, standard deviation, confidence interval, etc.) and indicate the size of the sample used. Similarly, when using mathematical models, the Proponent shall indicate the prototype used, the accuracy, and the inherent limits of interpretation.

131. Temporal and spatial boundaries must be determined on the basis of the potential impacts on the particular biophysical or social phenomenon being addressed.

132. Various methods have been developed in the social sciences to gather the knowledge of resident populations. The Proponent shall explain and justify the methods used. Insofar as possible, interviews shall be recorded, transcribed and made accessible for consultation. Those recorded in Native languages shall be translated into French or English. Generally accepted rules of ethics in the social sciences, in particular those which aim to protect people's reputations and the identity of subjects interviewed, shall be respected. If written data concerning people's knowledge or opinions is used, the Proponent shall provide references and shall make the texts publicly available. The Proponent shall also explain the methods used to account for the knowledge, opinions or conceptual and symbolic systems derived from such interviews and texts.

133. Where essential data are missing and cannot be collected, the Proponent must advise the administrators and the review bodies, who reserve the right to initiate independent research should they deem additional studies necessary or to propose other measures. The Proponent shall evaluate the significance of the absence of data from the study area. The Proponent shall also refer to existing relevant literature carried out in similar conditions elsewhere and shall describe the limits of interpretation imposed by this type of data.

134. Various regional organizations have already conducted studies on the biophysical and social milieu. The Proponent shall describe any cooperative arrangements made with these organizations, with specialized research centres or with any other institution or person with recognized expertise in specific research areas pertinent to the study area. Furthermore, the Proponent shall consult the appropriate government agencies and shall provide a report on those consultations.

135. Wherever the Proponent makes use of qualitative criteria to compare various design and development options, to describe the environment, or to assess impacts, each of these criteria shall be defined, their relative importance stated, and the differences between the categories (e.g., desirable, acceptable, unacceptable) indicated. The Proponent shall justify the classification of each criterion.

136. The Proponent shall explain the methodology used to predict the impacts on the biophysical and social environments, and shall validate any model used for this purpose. All studies used in the prediction of impacts must be specified, a data base organized, the original authors identified and the studies made public. All statements based on public consultation shall be justified and the sources and methodology specified. The choice of methodologies and interpretation of results shall be justified in light of current theories, knowledge and standards. The Proponent shall review the theory and practice of cumulative impact assessment and shall justify the methodology proposed.

137. The Proponent shall support all analyses, interpretations of results and conclusions with an extensive review of the appropriate literature, providing all references required and indicating the public availability of all works consulted, when appropriate. Any contribution based on traditional knowledge used shall also be specified and sources identified. The Proponent shall also define all technical terms used in the EIS and include these in a glossary.

ORGANIZATION OF THE GUIDELINES

138. These guidelines require the Proponent to justify the proposed project (Chapter 2), to describe the biophysical and social environment (Chapter 3), to describe the proposed project and variants (Chapter 4), to predict the changes and impacts that would result from it (Chapter 5), to describe the mitigative measures that the Proponent proposes to undertake if the project is approved, along with any compensatory measures for residual impacts (Chapter 6), and to describe the management and monitoring of the project over time, including measures to enforce compliance with the terms that may be set out in the authorization (Chapter 7).

PRESENTATION OF THE EIS

139. The Proponent shall provide an EIS which is complete, including references to scientific works and to the Proponent's sectorial studies. The EIS shall respect the structure of these Guidelines. All scientific and sectorial studies shall be rendered current and shall be numbered and dated prior to their submission to the review bodies for examination. Maps, other than those used for orientation and context, shall be contained in a separate volume. The EIS shall be supplemented by a series of complementary documents providing technical and scientific support and containing appropriate bibliographic references. The Proponent shall prepare and incorporate in the EIS a complete and detailed annotated bibliography of all studies and reports carried out in relation to the proposed project since 1975, and shall make such studies and reports available to the review bodies.

140. The Proponent shall submit a table of conformity in an appendix, showing where each requirement of these Guidelines has been satisfied.

141. The EIS shall be published simultaneously in French and English. The complete document or an abridged version of it shall be made available in Cree and Inuktitut, in written and audiovisual format. The abridged version shall be sufficiently detailed to permit evaluation of the proposed project by the Cree and the Inuit. Maps should indicate common and accepted place-names usually referred to by the local populations in their own language, in addition to the French and English names.

CHAPTER 2

PROJECT JUSTIFICATION

INTRODUCTION

201. The justification of the proposed project must address in detail the following six issues related to energy planning, namely:

1. load forecasting and analysis;
2. alternative solutions to satisfy the anticipated demand;
3. system-planning issues;
4. the evaluation of different equipment program scenarios;
5. alternative designs of the proposed project (major project variants);
6. financial forecasting and rates analysis, including the analysis of different scenarios and rate structures.

202. Prior to evaluating the potential environmental impacts of the proposed project, the Proponent must first demonstrate that there is a need for new or additional electrical generating capacity and energy resources, and that the best scenario for meeting that need includes the proposed project. This involves first assessing the need, and then comparing the various resources that could be developed to satisfy it. These alternatives include the construction of new generating capacity and purchases from neighbouring systems (supply-side resources), as well as the implementation of new programs to reduce demand growth (demand-side resources). The Proponent shall present an overview of the energy policy adopted by the Government of Quebec. The Proponent shall in particular present the objectives of this policy with respect to electricity, and shall then explain how the proposed project fits into this context and into the Proponent's development plan.

203. The Proponent is asked to provide basic information regarding load forecasts, supply- and demand-side resources, overall system characteristics and financial parameters. This information shall be combined and

analyzed in such a way as to determine the best sequence of resource acquisition for meeting projected electrical energy needs.

204. The documentation provided shall include all information and material necessary to assure a high standard of expert review, including data, assumptions, sources, models and methodologies used, which shall be transparent and reproducible. Financial information shall be presented in constant dollars of a single reference year.

205. The analysis shall cover two time periods. The planning period covers the years 1992-2022. The historic period includes the years 1970-1991.

206. The Proponent shall carry out a least-cost analysis regarding the selection of supply- and demand-side resources to meet its load forecasts. These shall be based on forecasts both for capacity and energy needs (paragraphs 213 to 222) and a description of all available supply- and demand-side resources (paragraphs 223 to 251), together with the operational information needed to compare the projects (paragraphs 252 to 258).

207. Direct and indirect costs per unit of capacity and energy must be specified for each resource. Combining this information, the Proponent shall order the various supply-side and demand-side resources in order of increasing cost, both for capacity and for energy.

208. Costs related to transmission losses and reserves shall be apportioned among supply-side resources, except for certain reserve provisions, which should be included in demand-side costs. Furthermore, the Proponent may choose to add a percentage to the effective cost of supply-side alternatives for the purpose of favouring energy conservation and efficiency.

209. The Proponent shall determine the optimal sequence of resource acquisitions for each demand scenario, explicitly addressing the role of uncertainty in forecasting future loads and in the choice and operation of future resources. The Proponent shall explain the system optimization models used and their application to the selection of resource acquisitions, as well as the methods and models used to address uncertainty. Detailed sensitivity analyses with regard to changes in supply and demand assumptions shall be provided.

210. Other factors may play a role in the selection of resources, such as potential planning risks or benefits related to fuel diversification or planning flexibility. The Proponent shall explain how its system optimization procedures take such factors into account.

211. The analysis described above will demonstrate the least-cost solution to each demand-growth scenario, but does not take into account any factors which are "external" to the Proponent's balance sheet. Such external costs, or "externalities," include social and environmental impacts as well as broader effects such as job creation and economic stimulation. Some of these externalities, whether related to supply- or demand-side resources, lend themselves well to quantification, others not. The Proponent shall present a series of tables comparing the impacts of each supply- and demand-side resource discussed in paragraphs 223 to 251 for each potential positive and negative externality. To the greatest extent possible, the Proponent shall make this comparison on a monetary or quantitative basis; however, for those impacts which do not lend themselves to quantification, the comparison shall remain qualitative.

212. The costs and benefits associated with power production are seldom incurred by people from the same geographic region and cultural group. In order to evaluate the extent of this potential inequity, the Proponent shall compare the costs and benefits of project development or non-development for the Native populations and the population of southern Quebec.

LOAD FORECASTING

213. The assessment of need for new electrical generation begins with load forecasting. Load forecasting involves projecting economic growth and technological changes, sector by sector, to predict future needs for electrical energy. Traditionally, load forecasts are broken down into three major sectors: residential and farm, general and institutional, and industrial, and into several scenarios, ranging from low to high growth. The Proponent shall present an analysis of the factors influencing consumption and changes in consumption patterns in each sector, as detailed in paragraphs 215 to 218.

214. Other elements of the load forecast depend not only on a detailed analysis of economic variables, but also on decisions made by the Proponent and on energy policy, which is determined by the Government

of Quebec. Such elements include future export and risk- and profit-sharing contracts. These shall therefore be addressed separately, and the scenario analyses presented in subsequent sections shall explicitly account for their contribution to demand.

Current commitments

215. The Proponent shall provide its most recent domestic load forecasts, both for power and for electricity. These forecasts shall include regular needs and existing export and risk- and profit-sharing contracts, including capacity options. The forecasts shall be broken down into at least three scenarios (high, medium and low), and the relative probabilities of each scenario shall be estimated for each sector (industrial, general and institutional, residential and farm).

216. The Proponent shall provide data for both the planning period and the historic period, with descriptions of all econometric and end-use models used to predict power and electricity demand for each sector, including the methodology and theoretical bases that underlie each model as well as an assessment of their strengths and weaknesses. An explanation of the input variables and assumptions for each sectoral model shall also be provided.

217. The Proponent shall present the most recently available forecasts for residential and farm, general and institutional, and industrial sectors. The Proponent shall also provide recent forecasts from neighbouring utilities (Ontario, New Brunswick, New York and New England) and agencies such as the Northeast Power Coordinating Council (NPCC) or the National Electric Reliability Council (NERC) and, where their forecasts differ substantially from the Proponent's, explain the reasons for the differences.

218. The documentation of the Proponent's forecasts shall include the following information:

1. information on penetration and saturation for each major end use (e.g., space heating, water heating, electrical motors, electrolysis, smelting and refining, cooling and lighting), including expected technological developments (new end uses and electro-technologies) and their effects on demand;

2. the most recent forecast of load factors and load duration curves, with a discussion of how they are determined, the projected change, and the factors responsible for this change;
3. assumptions concerning weather-sensitive load, taking into account the best available estimates of local and global climatic trends during the planning period;
4. macro-economic indicators, including GDP, inflation, interest and exchange rates. If the estimates are from a third party, the Proponent shall identify the source;
5. demographic projections, including the variables used in the models;
6. assumptions concerning any anticipated sales of surplus energy within Quebec over the planning period;
7. a discussion of price elasticity in the Proponent's markets, indicating how the load forecasts take into account anticipated changes in rate levels and structures over the planning period;
8. identification of market segments where there is competition with other energy providers, and an analysis of the impacts of price variations on sales within these markets;
9. determinants of demand and growth for each subgroup of the industrial sector forecast, with documentation and rationale of the explanatory variables selected, addressing specifically the pulp and paper industry (describing major categories of output and pulping methods) and the energy-intensive industries (including industry price, production and profit levels and the timing of new production capacity additions);
10. an analysis of the Proponent's electrotechnologies program, including external forecasting sources utilized and discussing its penetration and its impacts on overall demand and industry costs; and
11. a description of the effects of any energy efficiency programs other than those of the Proponent and of any existing or anticipated appliance or building codes, to the extent that they are included in the load forecast.

Additional demand

219. The Proponent shall indicate the impact of a range of export and risk- and profit-sharing contract levels and scenarios on load forecasts.

220. The Proponent shall assess relevant export markets and existing and anticipated export contracts and opportunities, and any scenarios which have been developed regarding export loads; explain the criteria used to determine whether to enter into new export contracts and/or renegotiate existing contracts; and provide projected annual sales figures (energy and

capacity) and expected revenues for all negotiated or anticipated exports. The Proponent shall also explain the comparative advantages of export of surplus and firm energy, providing a detailed economic analysis concerning the costs and benefits of each.

221. The Proponent shall explain its financial framework for analysing the impacts of export commitments on system planning and discuss the effects of the scenarios described above on resource acquisitions.

222. The Proponent shall then present and explain any anticipated additional risk- and profit-sharing contracts, including an analysis of the expected impacts of recent U.S. trade rulings on the risk- and profit-sharing contract program.

RESOURCES

223. Alternatives for meeting new demand include both supply-side and demand-side resources. Supply-side resources include hydroelectricity (including the proposed project, other hydroelectric projects, including mini-dams and run-of-the-river projects, intensified use of developed river systems such as the La Grande, Manicouagan, St. Lawrence, etc.), thermal (fossil, biomass and nuclear), purchases from neighbouring areas (including Labrador) as well as from private producers in Quebec (including cogeneration), and other technologies, including wind, solar, geothermal. Demand-side resources include various strategies for load management and conservation, including those that involve rate design, incentives or other pricing structures.

Supply-Side Resources

224. In order to permit comparison of a wide variety of supply-side alternatives, the Proponent shall provide general financial information such as forecasts of discount rates, financial costs, inflation and risk premiums, explaining all hypotheses and assumptions.

225. The Proponent shall provide detailed information (broken down by unit where relevant) concerning the cost, operations and timing for each of the supply-side resources mentioned in the preceding paragraph, as follows:

Energy

1. installed power (MW), projected annual firm and non-firm electricity output (GWh), and seasonal output pattern, including specific determinants for each resource (e.g., runoff projections for hydro projects, wind strength and persistence projections for wind projects), including data, assumptions and supporting studies; and
2. availability factor, load factor and transmission losses expressed in units of capacity and energy.

Costs

3. capital costs (direct overnight costs and financing costs during construction, broken down into generation and transmission components) and total in-service cost, allowing comparison with other resources;
4. fixed and variable operations and maintenance costs, including assumptions for waste disposal, where relevant;
5. real levelized cost per kilowatthour and per kilowatt (broken down into capital, operations and maintenance and fuel costs, when applicable), with detailed explanation of the methodology for determining that cost, and the impact of each resource addition on the total real levelized cost per kilowatthour and per kilowatt of electricity produced;
6. sensitivity analyses concerning costs as a function of the successive changes in the main assumptions underlying the calculations (inflation, wage increases, basic cost of each project, etc.) and other factors described above;
7. expected mitigation and compensation costs; and
8. a full description and basis for project schedules, including in-service and retirement dates, an analysis of schedule constraints, and factors and uncertainties affecting project schedules and potential feasibility.

Hydroelectricity

226. The Proponent shall explain its methodology for hydroelectricity operations planning. If firm output is established by a system-wide analysis, the Proponent shall include the analysis, including models, data, and an explanation of the methodology.

227. The Proponent shall explain its policy and plans concerning the development of small-scale hydroelectric resources and the expansion and rehabilitation of existing hydroelectric facilities. This shall include a

calculation of the province-wide potential for such development, according to different economic assumptions.

228. The Proponent shall present the effects on the per kilowatt and per kilowatthour costs and on system planning of high, medium and low runoff scenarios during the analysis period. The low runoff scenario shall include conditions like those experienced in the La Grande region from 1984-1991.

229. For the entire hydroelectric system (including Churchill Falls), and specifically for the river basins affected by the proposed project, the Proponent shall explain and document the historical and expected value runoff (with energy equivalents) for each river basin. Documentation shall include any studies and materials used to determine probability distributions and other analyses concerning runoff variability. The Proponent shall also provide an analysis of long-term variability from historic runoff data, taking into account the best available information concerning long-term climatic trends.

230. The Proponent shall present the implications of each design option within the selected variant of the proposed project with respect to energy and capacity output and operational characteristics such as inter-annual storage. If the Proponent anticipates substantial (multi-year) delays between distinct phases of the project, each intermediate stage shall also be considered an alternative for the purposes of this economic analysis, in order to evaluate the economic viability of the project in the event that later phases are not completed. Costs shall be specified per kilowatthour and per kilowatt, and shall be broken down into their generation, infrastructure, collector system and transmission components.

231. For each design option, the Proponent shall provide the information described in paragraph 225, where applicable, for each station within the project.

Thermal and other generating technologies

232. The Proponent shall provide information including capital costs and heat rate (efficiency) for all thermal generating technologies under consideration, including fossil fuels, nuclear and biomass; price forecasts (per gigajoule or BTU), including purchase of reserves (when appropriate) for oil, natural gas and other fuels; and descriptions of specific pollution-

control and other environmental protection technologies, including costs and impacts on emissions and other environmental effects.

233. The Proponent shall also provide studies concerning the cost, potential, and reliability for each potential resource; a survey of current and anticipated technological innovations for each technology, and their impacts on cost, capacity, utilization factors and reliability; and explicit assumptions concerning resource cost and availability of each option over the planning period, as called for in the studies and surveys mentioned above.

234. These studies shall summarize experience gained from major wind and solar projects in North America and elsewhere, and discuss their applicability to Quebec's geographic and operational context. The Proponent shall in particular discuss the issues involved in integrating wind energy into the existing system.

235. Analysis of new technologies shall be as rigorous as that of other resources. The degree of uncertainty in the supply characteristics of each type of installation shall be characterized, and the system-wide implications of integrating projects of various sizes and types shall be evaluated.

Purchases

236. From within Quebec. The Proponent shall provide estimates for its purchases from Quebec independent producers, including type and location of resource and purchase duration, as well as an explanation of the Proponent's relevant policies.

237. Cogeneration. The Proponent shall describe its current policies concerning cogeneration, specifying what types of cogeneration can be integrated into the existing system; shall estimate the cogeneration potential, by sector and by type of industry; and shall provide an analysis of current and forecasted market potential for each one.

238. From outside Quebec. The Proponent shall describe all potential purchases from outside Quebec. For each one, the Proponent shall state the provenance, the estimated size (in energy and capacity) and duration, including commencement and/or termination dates, as well as any other relevant information.

Demand-Side Resources

239. Part of the need for power and energy can be met by appropriately reducing or managing demand. Programs to reduce demand for peak power capacity (peak demand management) and energy (conservation) are hereafter referred to jointly by the term "demand management". Such programs may include dual energy and other types of fuel switching, alternate rate structures, and other strategies, including incentive programs to promote the development, acquisition and adoption of energy-efficient equipment, materials and practices, public education campaigns, interruptible power contracts, and regulations, norms and standards.

Current and planned demand management programs

240. The Proponent shall describe its current demand management policy, targets, and existing and planned programs, with cost, anticipated capacity and energy savings and expected penetration rates (year-by-year) for each program, including descriptions of existing and potential interruptible power contracts, throughout their projected effective duration.

241. The Proponent shall describe all programs that have been evaluated but have not been implemented, giving the reasons for their rejection or for delay in their implementation. The Proponent shall describe the economic tests used to evaluate demand management programs, including those rejected.

242. The Proponent shall estimate annual program expenses, explain the basis used to establish appropriate spending levels, describe the proportion of expenses to be borne by various parties and the basis for annual savings estimates, and discuss the basis for setting annual targets and the possibility of modifying demand management programs to achieve higher levels of savings.

Estimating demand management potential

243. The Proponent shall provide estimates of the technical, cost-effective, and achievable demand management potential for the duration of the planning period by end use, sector and demand scenario, along with the studies forming the basis of such estimates. Also, the Proponent shall

evaluate the potential for all types of interruptible power contracts, including a discussion of their use elsewhere in North America.

244. For all measures which form part of the technical but not the cost-effective potential, the Proponent shall estimate probable changes in the cost of these measures for the duration of the planning period, indicating if and when a measure would become cost-effective.

Other demand-side resources

245. The Proponent shall describe all other reasonable measures that could be adopted for reducing demand for power and electricity, including potential and planned system improvements to reduce transmission and other losses. For each one, the Proponent shall specify the cost, the technical and cost-effective potential, the useful life, the amount of energy saved per typical client and the number of potential clients.

246. For each measure, the Proponent shall describe reasonable approaches for promoting its adoption. These approaches include, among others, information and advertising, standards, norms and regulations, technical and financial assistance, rate structures and levels, direct subsidies, and any other relevant approach. For each approach, the Proponent shall then identify and characterize the obstacles preventing or limiting its adoption.

247. For each approach, the Proponent shall identify a range of plausible programs of differing durations and funding levels. Upper and lower estimates of the penetration rate for each program shall be provided, along with explanation of the factors affecting it. The expected energy and capacity savings for each program shall be estimated, and nominal and real levelized cost per kilowatthour and per kilowatt calculated, with capital costs amortized as for supply-side resources.

248. For each program, the Proponent shall identify all positive and negative interactive (or cross-) effects, explaining and justifying in detail how these effects are accounted for in calculations of demand management potential, and shall compare the electricity and power currently used, identify the cost of the relevant measures (by kilowatthour and by kilowatt saved), and the percentage of projected usage that would be saved by each measure, for each type of end use. These programs, or reasonable groupings thereof, shall be treated as demand-side resources for the purposes of the least-cost analysis called for in paragraph 206.

249. Fuel switching. The Proponent shall describe existing dual energy programs, assess other possible approaches to using other fuels to reduce peak capacity and energy demand, including promoting the use of natural gas and solar energy for space- and water-heating needs, and summarize the costs and demand savings of these programs.

250. Rate structures. Changes in rate structure can create or eliminate incentives for conservation in a significant way. The Proponent shall describe a broad range of rate structures, including a survey of those used in other North American and European jurisdictions. For each one, the Proponent shall estimate the impact on energy and capacity demand, and shall describe program and any other costs. The discussion should address, among others, increasing block consumption charges (for each sector), time-of-use rates, capacity-related hookup charges, domestic capacity charges, and optional marginal rate pricing.

Externalities

251. For each supply- and demand-side resource, the Proponent shall provide a characterisation and qualitative estimate of its externalities, both positive and negative. For the proposed Great Whale River hydroelectric project, these will be drawn from the analyses required in Chapter 5 of these guidelines. For other resources, they shall be determined according to the best information available to the Proponent. For each resource, the Proponent shall also provide a description of the social and economic impacts on Quebec as a whole, including job creation (including the nature, type and number of direct, indirect and induced jobs generated, their duration, which groups are most likely to benefit from these jobs, and where they will occur), macro-economic effects (e.g., degree of economic stimulation, effects on public access to credit) and independence from out-of-Quebec energy sources. For thermal generating technologies, description of externalities shall include potential negative impacts related to air emissions and discharge of heated water, as well as any other adverse environmental effects. For major purchases, and to the extent that such purchases are tied to specific resources, the Proponent shall provide information on those resources and characterize their externalities.

SYSTEM PLANNING

252. Understanding the Proponent's system planning is crucial to assessing requirements for new supply. System planning assumptions and criteria, which are routinely developed to guide short- and long-term planning and operations, include reserve provisions and hydraulic operational parameters.

253. For each year of the planning period, the Proponent shall provide: the total energy and capacity sales (broken down into firm Quebec, surplus Quebec, firm exports, surplus exports, and energy reserve margin, if applicable); the total energy and capacity supply, broken down by source, including existing hydro plants, existing thermal plants, new generation by project, purchases, and exceptional operating measures, with a full description of measures and effects; and the other inputs and outputs to the hydro system, such as runoff, reservoir drawdown/refilling and spillage (as in the Electrical Energy Balance Sheet in the Proponent's *Development Plan*).

254. Reserve provisions are needed to meet equipment outages, system emergencies, and periods of low precipitation. The Proponent shall explain how reserve margins affect system operations and the costs and selection of resources. The analysis of reserves should include a review of basic planning policy and reserve standards and requirements imposed by government bodies. Also, the Proponent shall provide information regarding current reserves and its assumptions concerning required capacity reserve margins (for each year of the planning period), as well as a probability analysis concerning loss of load, which establishes overall reserve requirements.

255. The Proponent shall also provide the basis for the criteria established for reserve margins, including any studies and guidelines established by either the NPCC or the NERC, its assumptions concerning the load-carrying capabilities of each resource, or quantification of the impact of each type of resource on reserve margins, and an analysis of the effect of additional demand- and supply-side resources on the required reserve margins.

256. All operating agreements and commitments with neighbouring utilities, agencies such as NERC and any other private producers shall be

identified, as well as the system emergency rules for domestic and export loads.

257. Losses shall be specified for each sector and on an aggregate basis for the risk- and profit-sharing and export contracts. For both energy and capacity, the Proponent shall provide information concerning total losses and high voltage transmission losses by diurnal and seasonal loadings.

258. The Proponent shall also indicate the probability and severity of power outages due to accidents, sabotage or natural disturbances, the measures taken or under consideration to prevent or minimize them, and the costs of these measures.

FINANCIAL PARAMETERS

259. While it is understood that the responsibility for establishing rates belongs to the Government of Quebec, the information shall include all costs and other financial information in sufficient detail to permit calculation of revenue requirements and anticipated rates.

260. The Proponent shall submit a financial model bringing together variables such as demand, rates, sales, revenues, borrowing, investment, interest, amortization and net worth.

261. The Proponent shall also present a detailed review of the financial parameters used, including the most recent version of *Paramètres économiques et énergétiques de planification à long terme*, and any other related documents.

262. Financial forecasts. For each of the high, low, and medium demand scenarios as described in paragraphs 215 to 222, the Proponent shall provide a financial forecast for the full planning period and shall indicate the probability of each scenario occurring.

263. The Proponent shall also provide: revenue and energy sales for each sector including overall information concerning risk- and profit-sharing and export contracts; financial information of the type provided in Tables 13 through 16 of the *General Report* (follow-up of the *Development Plan 1990-1992, Horizon 1999* as of December 31, 1991) for the full planning

period; and best- and worst-case scenarios based on financial parameters (interest rate, inflation, exchange rate, etc.).

264. Rate forecasts. The Proponent shall provide estimates of rates, volume of sales, total revenues and revenue variability (across scenarios by category of customer); an analysis of consistency between the volume of sales (TWh) and sales revenues assumed in the financial forecast and the electricity prices assumed in the load forecast; and the impact of high, low and medium demand scenarios on year-by-year increases in the Proponent's regular rates for the planning period, taking into account the investments required to meet future demand, explaining all assumptions.

CHAPTER 3

DESCRIPTION OF THE BIOPHYSICAL AND SOCIAL ENVIRONMENTS

INTRODUCTION

301. This chapter of the EIS is meant to establish baseline data in relation to which the predicted biophysical and social impacts of the proposed project (Chapter 4) will be evaluated (Chapter 5). The object is to describe the history, change and current state of the environment of the region under study which might be altered as a result of the proposed project, if it is approved.

302. Three principles shall guide the description of the environment and its components. The Proponent shall provide a definition of the environment in keeping with the multicultural character of the territory in which the proposed project would be built, shall identify and target the analysis of the valued ecosystem components, and shall indicate and justify the spatial and temporal boundaries assigned to each component. Once this has been done, the Proponent shall have outlined a portrait of the environment in which the proposed project would take place in a way that each affected cultural group could recognize, and in all cases particular emphasis shall be accorded to the interactions between ecosystems and human communities.

A MULTICULTURAL DEFINITION OF THE ENVIRONMENT

303. The Proponent shall provide a detailed description of the components of the environment which would be affected by the proposed project, based on the experience and knowledge of each concerned group. This chapter presents a framework based on generally accepted scientific methods, which will be used as a minimum for describing the environment. As mentioned above, the Proponent shall ensure that this description is adequate in relation to Chapter 5.

304. While the process of classifying the valued components and the structure of the environment is universal, the manner of performing such

classifications is culture-dependent. Thus the Cree, the Inuit and other inhabitants of the region affected by the proposed project may well define the environment around them in different ways. Therefore, in addition to defining the environment in accordance with state-of-the-art scientific methods, the Proponent shall also describe it in accordance with the acquired knowledge of the Cree and Inuit, making use, among other methodologies, of those developed in the field of ethno-science.

ENVIRONMENTAL COMPONENTS

305. In order to properly organize and target the description, the Proponent must define the valued ecosystem components recognized by each of the cultural groups concerned, as well as those components that they consider to be threatened by or vulnerable to the effects of the proposed project.

306. Valued ecosystem components. Human communities value particular elements of the environment. In certain cases, the same elements may be valued by different groups, although the reasons may vary. In terms of the components valued by the Western scientific community, current knowledge can, for the most part, provide a framework for organizing the description of the environment. The Proponent shall identify and group the environmental components valued by each community (Cree, Inuit, Naskapis, non-aboriginal population in the region and the province), within a classification system which takes each culture into account.

307. Components perceived as being threatened. In order that the studies be closely linked to the impacts of the proposed project anticipated by the different cultural groups, the Proponent shall concentrate on those components perceived as threatened. To this end, the Proponent shall refer to the information meetings already held in the communities and to the public scoping hearings held by the review bodies.

BOUNDARIES

308. Geographic boundaries. The boundaries of the area which may be affected by the proposed project vary, depending on the nature of the phenomenon considered. For example, given the migration of certain aquatic, terrestrial, and avian species, the range of biological concern

could extend beyond the limits of the watersheds directly affected by the project. Hunting, fishing, trapping, and harvesting along the coastline and inland also mean that certain impacts on the activities of the relevant populations could also extend beyond these boundaries, notably to the residents of the Belcher Islands. The same could be said of the many activities related to the transportation of goods and services and to the traffic of people travelling to or from the area. Thus, while a number of impacts will be concentrated within a relatively restrictive study area, others will involve larger areas. The Proponent shall therefore specify and justify the study area for each component of the environmental description, taking into account the boundaries of each component and those recognized by each cultural group, and selecting the larger area if the various boundaries for a given area are not the same.

309. Temporal boundaries. In addition to the geographic dimension, the Proponent shall also consider the temporal dimension, including multi-annual cycles and seasonal variations for each component of the environment and shall determine the appropriate temporal boundaries for each.

310. Historical trends. In order to properly assess the impacts of the proposed project, the Proponent must identify historical trends. For each component, the Proponent shall determine how far in the past the study should begin and how far into the future it should be carried. In order to select these temporal boundaries, the Proponent shall take into account the limits generally recognized by each of the affected cultural groups. If these limits differ for a single component, the Proponent shall select the longer period.

PHYSICAL ENVIRONMENT

Climate

311. Climatic changes. In order to study the climatic changes which could result from the Project, and the influence of the present climate on operating conditions, the Proponent shall provide detailed descriptions of the past and current climates of the Great Whale, Little Whale and Nastapoka river basins.

312. Climatic parameters. In addition to conventional climatic parameters related to temperature, precipitation and wind, this description

shall include a detailed study of the particular climatic conditions observed in the region, especially for zones with high risk of fog and other microclimates.

313. Vegetation. The description of the climate shall include an appraisal of the length of the growing season and of ground-frost conditions, and shall include an analysis of the relationship between surface vegetation and regional climatic conditions.

Geology

314. Geological study. The Proponent shall provide a geological study of the region in order to provide baseline data on the geochemical background of certain trace metals, to establish the structural context and the possible levels of induced seismicity, and to determine the geological conditions that affect the physico-chemistry of lakes and soil and the productivity of plant communities.

315. Geochemical study. The geological study shall include a geochemical study of the bedrock, principally aimed at establishing background levels and regional variations of trace metals such as mercury, copper, lead, cadmium, arsenic and zinc.

316. Seismicity. The Proponent shall establish the current seismicity level as indicated by available seismograph records, as well as the paleoseismicity of the region using recognized geophysical and geological methods. All possibly significant regional faults must be identified, either by geological or geophysical means or by remote sensing.

317. Mineral claims. In addition, the Proponent shall locate existing claims and identify known resources and mineral showings and indicate, as much as possible, their potential for economic development.

Geology of surficial deposits

318. Map. In order to identify potential erosion zones, to establish background levels and regional variability of potentially toxic trace metals in the drift, and to determine the natural conditions partly responsible for controlling the physical chemistry of the lakes, the Proponent shall provide a geological map of the surficial deposits and the geomorphology of the region.

319. Geotechnical study. The surficial geological map shall point out the location of areas prone to erosion, slope instabilities and other mass movements. Where appropriate, the Proponent shall gather and provide pertinent geotechnical data necessary to properly assess the erosion or mass movement problems.

320. Drift geochemistry. The geological study of the surficial deposits will include a drift geochemical survey to establish current background levels and regional variability of trace metals such as mercury, copper, lead, cadmium, arsenic and zinc in the fine portion of the sediments.

Exceptional sites

321. The Proponent shall provide an inventory of all sites particularly representative of the milieu or exhibiting unique physical or biological features in the region of the proposed project. The surficial geological map shall indicate the special sites or landforms that warrant protection because they are unique or remarkable, according to the residents of the region and others. The uniqueness of any sites which might be submerged or altered as a result of development shall be described. The stranded shorelines around Lac Fagnant and the terraces along the Great Whale River are examples of such features.

Soils, peatlands and permafrost

322. Soils. In order to assess the capacity of the environment to support surface vegetation and possible re-vegetation, the Proponent shall describe the soils in the study area. This description shall include but not be limited to the order and the main groups of soils in the study area, as well as the thickness, geographical distribution, productivity, and organic content of the soils.

323. Peatlands. The Proponent shall pay particular attention to peatlands, and shall map their distribution and thickness (estimated or measured). Their geochemical characteristics shall also be established, particularly with regard to their content of potentially toxic trace metals (mercury, copper, lead, zinc, arsenic and cadmium).

324. Permafrost. The Proponent shall provide a map of the distribution of the permafrost in the study area. In particular, the Proponent shall provide a map of the distribution of the palsa bogs and permanently

frozen parts of peatlands in the regions that could be flooded as a result of the proposed project, and shall determine the extent, depth, and ice content of the permafrost. The Proponent shall assess the amount of ice that could be melted as a result of flooding and the levels of metal that could be released as a result of melting.

AQUATIC ENVIRONMENT

Freshwater environment

Hydrology and hydraulics

325. Hydrology. For each watercourse that will be disturbed, the Proponent shall provide an analysis of the annual hydrological regime, including data on frequency, volume, and duration of flood and dry-weather discharges.

326. Ice. The Proponent shall determine the most likely dates of the fall freeze and the spring thaw, and their annual variability for zones downstream from the turbines, and shall also describe the types of breakup, types and locations of ice jams, the extent of flooding associated with ice jams, and the relationship between coastal ice and river ice.

327. Hydraulics. In order to examine the quality and productivity of habitats that will be destroyed or affected by river diversion, the Proponent shall provide a map of the watersheds and the relevant hydraulic characteristics of each section of each river. The Proponent shall make use of these characteristics to determine the appropriate residual flow that should be maintained in order to protect major aquatic habitats.

Physical chemistry of surface water

328. The Proponent shall define the physical and chemical properties of the surface waters of the study area, including but not limited to the thermal regimes of northern rivers and lakes and the main factors governing them, and the physical and chemical characteristics of test-case lacustrine and riparian environments, in which the selection of parameters, the number and location of sampling sites, and the frequency

of sampling will be determined. This portrait should be representative of the annual cycle and of the interannual variability used for analysis.

329. The Proponent shall present the following parameters and discuss the methods used for analysis and sampling: conductivity, pH, bicarbonates, minimum and maximum temperature, dissolved oxygen, transparency, colour, turbidity, suspended matter, total phosphorus, total Kjeldahl nitrogen, nitrites and nitrates, silica, total inorganic and organic carbon, tannins and lignines, chlorophyll and pheopigments, calcium, sodium, potassium, magnesium, manganese, iron, chlorides, sulphates and appropriate trace metals known to be potential contaminants. The description shall also include the identification and concentration of other contaminants, when appropriate.

330. The Proponent shall specify, on an annual basis, the factors which determine the chemical composition of rivers and lakes on the Canadian Shield and shall indicate the factors which regulate or control physical and chemical variables such as alkalinity, organic carbon and metals in the environment under study.

331. The Proponent shall evaluate changes taking place with respect to each contaminant and the sources thereof (airborne or others) in the area under study, so as to be able to understand and predict any cumulative or synergetic impacts.

Biological characteristics

332. Plankton communities. The Proponent shall describe the composition of phytoplankton and zooplankton communities at different times of year to establish a succession profile for the major taxonomic groups. The Proponent shall also submit data on the available indices of primary productivity and shall discuss the reliability of these data in relation to on-site activity. The Proponent shall determine the zooplankton biomass in lacustrine and riparian ecosystems and shall explain the relative importance of different taxonomic groups in the productivity of the aquatic ecosystem and in energy transfers with adjacent ecosystems.

333. Benthic communities. The Proponent shall enumerate the major benthic groups in the lacustrine and riparian ecosystems of the study area and shall describe their relationship with the physical variables affecting their number and distribution.

334. Macrophytic vegetation. The Proponent shall provide a seasonal portrait of the distribution, location and composition of each aquatic plant community and shall discuss its importance as shelter or food for fauna.

335. Fish populations. The Proponent shall present a complete list of species encountered in the territory under study and shall indicate their preferred habitats, particularly their spawning areas. The Proponent shall provide an inventory of fish habitats in the area and shall indicate the geographic distribution of each species by season. The Proponent shall identify those factors which limit the distribution and population of those species of interest for Native diets and for sports fishing. The concentrations of contaminants in edible parts of fish shall be measured to provide baseline information.

336. Dynamics of fish populations. The descriptions of fish populations shall include the principal parameters of the population dynamics and the factors governing their abundance, notably: growth curves, physiological indices, and the relationship between length and weight; structure of the communities according to age and sex; age of sexual maturity and the reproductive cycle; fertility; estimates of mortality due to natural causes and to fishing; the diet of each species; interspecies relationships that control fish abundance and their communities, spawning grounds, hatchery zones, and migration routes, minimum oxygen requirements and temperature preference; and finally, the main fish parasites which influence the growth and survival of the most abundant species, with their life cycles and the factors currently limiting their geographic distribution.

337. Freshwater seals. The Proponent shall review existing knowledge of the genetic status, abundance, diet, recruitment, geographical distribution, preferred habitats, breeding season and mortality factors of freshwater seal populations. Special emphasis shall be placed on the population in the Lacs des Loups Marins, given its confinement there and its dependence on these lakes. The Proponent shall also discuss the limiting factors that maintain this population at its present level, and indicate how its environmental studies program will add to knowledge of this species.

Estuaries and marine environments

338. The study area for this section includes the estuaries of the Great Whale and Little Whale rivers, Manitounuk Sound and the eastern coastal

areas of Hudson Bay, particularly the areas near the Nastapoka, Ducks and Belcher Islands.

Physical characteristics of estuaries

339. The Proponent shall present up-to-date information on the characteristics of estuaries likely to be altered by the proposed project. Temperature and salinity gradients, brackish areas, mixing zones, tidal currents, average tide levels (high and low), as well as plume characteristics shall be identified as a function of river flow under natural conditions, with and without ice cover. All other hydrodynamic information required to understand the dynamics of the estuaries under study is also to be provided, including coverage, type, thickness and duration of ice cover. The Proponent shall describe the distribution and stratigraphy of post-glacial sediments present in the coastal and deep water areas of all estuaries affected by the project, and shall pay special attention to the configuration of the sand spit at the mouth of the Great Whale River and the configuration of the Little Whale River estuary. The effect of the wave regime, river flow, and littoral drift on the configuration of sand banks at the mouths of the estuaries shall also be examined.

340. The suspended sediment load and bed load at the mouths of estuaries shall also be determined as a function of river flow and tidal conditions.

341. The Proponent shall present a physical and chemical portrait of estuarine waters by referring to the parameters listed in paragraph 329, as well as the salinity and density of the water.

Biological characteristics of the estuaries

342. The Proponent shall describe the estuarine processes linked to primary and secondary productivity, specifying their role with respect to the ecology of invertebrates and fish and in the recruitment of anadromous fish populations. Up-to-date information shall be provided on the concentration of nutrients and on their importance to the wildlife frequenting the estuaries on a regular or periodic basis. The Proponent shall also investigate the role played by the mix of nutrients with respect to the biological productivity of fish at the larval stage and in the recruitment of anadromous fish.

343. Maps shall be provided showing the abundance and distribution of sublittoral vegetation at the mouth and on the banks of the estuaries. With regard to fish populations, the Proponent shall present data on the major species of anadromous fish in those estuaries which are likely to be modified. The following main points shall be discussed: the geographic distribution and abundance of the various species present (whitefish, speckled trout, etc.) as well as their spawning ground; insofar as possible, the identification of distinct populations; the reproductive strategies and limiting factors affecting annual migration cycles (salinity, temperature, water levels, ice and freshwater wintering); and the environmental factors affecting egg maturation and larval survival.

344. The Proponent shall establish growth curves for the various species present and shall evaluate mortality rates, both natural and due to fishing. Data on age at maturity and fecundity shall also be presented, as well as a discussion of variability in recruitment levels from year to year.

345. The Proponent shall present data on marine mammals in the estuaries, particularly the beluga, such as their abundance, recruitment, seasonal distribution, reproduction factors, preferred habitat, annual variability and migratory patterns. The Proponent shall provide a critical analysis of current knowledge of the estuarine environments of the Nastapoka, Great Whale and Little Whale rivers as habitat for belugas. The Proponent shall also take into consideration the population trends of belugas and their status in Hudson Bay.

Physical and biological characteristics of the marine environments

346. The Proponent shall present an analysis of the physical (temperature, salinity, circulation, ice conditions, etc.) and chemical oceanography of Manitounuk Sound, covering, in particular, the mixing processes that determine residence times for waters in the Sound and, insofar as they may be significantly affected, for coastal waters between the Great Whale and Little Whale river estuaries. Nutrient and sediment transport under natural conditions and the composition of the sublittoral vegetation of the Sound and the Hudson Bay coastline shall also be discussed and the ecological significance of naturally occurring ice-free zones shall be evaluated.

347. The Proponent shall review current knowledge of the following topics: bathymetry; primary and secondary productivity and the factors which govern them; the composition and abundance of benthic fauna; the

composition, abundance and life cycles of fish species and marine mammals; probable freeze and thaw dates and the nature and extent of freshwater plumes, including salinity and temperature profile.

348. The Proponent shall present current information on the distribution and ecology of the various species of marine mammals in Manitounuk Sound and in the southeastern part of Hudson Bay, focusing on the significance of the movement of marine mammals and fish between the area affected by the proposed project and the adjacent areas where these resources are exploited by the local population.

349. The level of contamination in marine mammals shall be evaluated, in order to obtain the baseline information necessary in the event that the proposed project proceeds.

350. The Proponent shall present information on the geographic distribution, abundance, diet, preferred habitat, mortality factors, reproductive factors, known contaminant levels and importance of marine invertebrates to Native diets.

351. The Proponent shall also present information on the geographic distribution, abundance, diet, preferred habitat, breeding grounds, recruitment, mortality factors, reproductive factors, contaminant levels, incidence of disease, age structure, genetic status, migratory patterns and sensitivity to disturbance of beluga whales.

MERCURY CONTAMINATION

352. The Proponent shall review the current state of knowledge and all pertinent literature on the biological, geological and chemical mercury cycle in northern climates. This part of the study should focus on exchanges between the atmosphere, surface water, and the terrestrial environment, and on the timeframe and characteristics of soil decomposition. It should also explain the physical, chemical and biological factors which govern them, as well as the inherent particularities of the study area.

353. The Proponent shall review the current state of the available knowledge on the bioaccumulation and toxicity of methylmercury with respect to fish, mammals and avifauna, and its sublethal effects on growth, survival and reproduction.

354. The Proponent shall provide an evaluation of the available analytical methods to determine the proportion of inorganic and organic mercury compounds, including methylmercury, in the environment. This evaluation shall deal with the various systems used for classifying types of mercury compounds and their significance. The Proponent shall also discuss operational constraints that affect the taking and storing of samples, as well as the limits of detection and reproducibility. The substrata analyzed should include at least organic and inorganic soils, water, and biological tissues, mainly from fish, birds and vegetation.

355. The Proponent shall determine current contamination levels and bioaccumulation rates for the various species of fish and marine mammals of each drainage basin affected by the proposed project, including marine and estuarine ecosystems. This study should specifically examine at least two piscivorous and two non-piscivorous species. The Proponent shall provide the models used, which shall take into account the half-life of methylmercury in the flesh of fish inhabiting reservoirs. The Proponent shall define the model(s) selected and justify its (their) choice. These reference data shall be measured in order to permit monitoring of future changes in mercury levels. The Proponent shall also determine the degree of bioaccumulation of methylmercury in the principal marine mammals in Hudson Bay and in piscivorous birds, as well as the distribution of organic mercury in the edible tissues and organs. If freshwater seals are included in the sampling, the study of mercury contamination shall include these animals.

356. Finally, the Proponent shall provide a study of mercury bioaccumulation downstream from hydroelectric projects, indicating the likely role of various bioassimilation pathways and the factors that govern the extent of this phenomenon.

UPLAND AND WETLAND ECOSYSTEMS

357. Upland vegetation and ecotones must be analyzed in terms of their indigenous plant communities (rare species, typical plant communities, area of distribution, limiting factors, etc.) and as animal habitat.

358. Plant communities. The Proponent shall describe the composition, distribution, controlling factors and dynamics of the most common plant communities, their soil and moisture requirements, and the role played by disturbances such as forest fires, and their role in supporting wildlife.

Particular attention shall be paid to the dwarf willow (*salix spp.*) stands used by ptarmigan in winter for feeding and shelter.

359. Wetland habitats. The Proponent shall classify the different types of wetland habitats based on plant communities and on drainage system type, in order to define the habitats that might be lost. Certain areas are of particular importance: Lac Bienville, the lower Coats and the Geoffroy River valleys, the Lac Paimpont region, and areas around Lac Kakupis and Lac Elizabeth.

360. Forest ecosystems. The Proponent shall describe the age structure of the region's forest ecosystems, using representative samples. The Proponent shall produce a map indicating plant communities in the study area and the distinctive physiographic seres in all sites affected by the proposed hydroelectric developments. Discussion of these physiographic seres shall include the type of bedrock, surficial deposits, drainage classes, soils, gradients (in degrees), and plant communities representative of the ecosystem by altitude class.

361. Rare species. The Proponent shall then discuss plant communities of interest to the region: rare plants, exceptional, endangered or regionally significant populations, range extensions, special habitats, and areas used by Native peoples where species of interest (for food, medicine, etc.) are found. These populations are to be localized and described using the remote sensing studies of the last twenty years, where appropriate.

362. Regeneration and reclamation. The Proponent shall examine current conditions to determine the regeneration rates of ecosystems in northern regions which have previously been disturbed by fire. The Proponent shall present current knowledge concerning the growth and regeneration of the main forest species and concerning reforestation of the region's spruce and pine forests. The Proponent shall especially take into consideration the experience acquired in the course of reclamation work carried out at the La Grande complex and elsewhere, and shall explain to what extent such work might be suitable for the region of the Great Whale complex.

363. Burnt-over land and fires. One probable consequence of opening the territory is the increased risk of forest fires. To evaluate the impact of fires, the Proponent shall describe the areas that have burnt over the past 30 years. This evaluation shall include maps of burnt-over areas, the origin and date of the fires (if known), and the current status of the area

(including any regeneration problems) and its use by wildlife and humans. This can be done making use of available remote sensing studies.

364. Wildlife habitats. An assessment shall be made of the quality and the quantity of available wildlife habitats, and particularly of those riparian and wetland habitats which could be lost or significantly affected by the proposed project, notably through the creation and operation of reservoirs. While riparian and wetland habitats may merit special focus, all habitats important for avifauna of any sort, for caribou (and other mammals) and for significant fish species must also receive special attention. The Proponent shall therefore determine the composition, diversity, and richness of wildlife species associated with these habitats, and shall also evaluate the wildlife productivity of each vegetation group for the region as a whole. Special attention shall be given to the factors most likely to affect the distribution of animals throughout the region.

365. Land animals. The Proponent shall describe the wildlife and its habitat in order to assess likely losses in number and biomass and in harvesting by all users, should the project proceed. For key species of birds and mammals (including caribou), the Proponent shall provide estimates of the following: body condition, age and sex ratios, habitat use, age of maturity, reproductive rates and success, mortality factors and rates of mortality. Key species shall be identified on the basis of, among other things, their abundance and their importance to the Native harvest, including that of the Naskapis and other Native groups.

366. Caribou. The Proponent shall present existing knowledge of the density and distribution of caribou and their population cycles over the past decades, and of the habitats used by this species during the course of one full year, including the migratory routes and birthing grounds used and their location with respect to the areas affected by the proposed project. The study shall include seasonal as well as year-to-year variations. The Proponent shall distinguish between the Lac Bienville herd (animals native to this region) and the Rivière George and Rivière aux Feuilles herds, which are used by the Naskapis, and shall specify how each herd uses the area proposed for development for migration, feeding and calving, and how the herds interrelate in terms of population dynamics. The Proponent shall outline the limiting factors (birthing grounds, habitats, predation, availability of food, poaching, resource development, hunting, climate, etc.) that have or could have an effect on caribou numbers and thus their density and distribution within the specific context of the study area.

367. Fur-bearing animals and other mammals. The Proponent shall provide and analyze inventories on the population dynamics, rate of exploitation, density, distribution, limiting factors and preferred habitats of the beaver, muskrat, mink, otter, wolverine, wolf, marten, red fox, arctic fox, fisher, black bear, polar bear, snowshoe hare, Arctic hare, musk ox and moose in the study area. Consideration shall also be given to any marine mammals, such as seals and belugas, likely to be found in brackish and fresh water. For species with a regular population cycle, the Proponent shall interpret data on population density and habitat use in light of the stage of the population cycle.

Birds

368. The Proponent shall provide an inventory and analysis of current bird populations (local and migratory), evaluating the number, distribution and life-cycle of bird species, especially waterfowl species of interest to Native peoples, and shall study their productivity and the factors governing it. The Proponent shall also provide an inventory of migratory birds of special interest to birdwatchers and hunters of North America.

369. Current information shall be presented on the use by waterfowl of the east coast of Hudson Bay, including the Belcher Islands, especially Manitounuk Sound, paying special attention to the eider duck. In addition, the importance of eelgrass beds, particularly to the Brent, shall be examined. The territory under study shall include the area from Long Island to the Nastapoka River estuary, as well as any other sector where resources could be affected.

370. In the Lac Bienville area, particular attention shall be paid to the Canada Goose, the Surf Scoter and the Black Scoter. Most importantly, the factors likely to affect the reproductive success of these last two species shall be discussed.

371. Ice-free zones at the foot of rapids in the rivers within the study area are extremely important to certain avian species. The Proponent shall locate and identify these zones and describe them in terms of the number of species that use them, their respective abundance, and their importance as a determining factor in the ecology of each species.

Vulnerable, rare, or threatened species and ecological reserves

372. From the standpoint of ensuring the diversity of species in the study area, the Proponent shall discuss the preservation of vulnerable, rare, or threatened species in the area concerned, as well as that of relevant plant communities and fragile ecosystems. This process will require input from various agencies, both provincial (ministère de l'Environnement [MENVIQ] and ministère des Loisirs, de la Chasse et de la Pêche [MLCP]) and federal (Environment Canada), as well as from the Native communities. The Proponent shall consult with them concerning flora, plant communities, land and marine mammals, fish and birds. Current information shall then be discussed, and any inventories deemed necessary by government authorities in order to permit a decision on the proposed project shall be performed. The Proponent shall present the current and anticipated protection programs which are or will be in effect in this area.

373. The Proponent shall provide a map showing all projected installations and the seven sites in the vicinity which are under consideration by the relevant government agencies as potential ecological or natural reserves. These sites are: Lac Bienville, Lac Burton and Rivière Roggan, Lac à l'Eau Claire, Lac Guillaume-Delisle, Pointe Louis XIV, and Lacs des Loups Marins. The map should allow the assessment of potential modifications to these natural systems.

COMMUNITIES AFFECTED BY THE PROJECT

374. The Proponent shall update the economic, social and cultural profile of the affected northern communities (Kuujjuarapik/Whapmagoostui, Chisasibi, Radisson, Umiujak, Inukjuak and Sanikiluaq) concentrating mostly on the second half of the twentieth century (1950 to date) and highlighting the determining evolutionary factors for every community, paying particular attention to current characteristics that make the communities more or less open to changes.

375. The Proponent shall review existing information pertaining to the demographics of the Northern environment in order to present a demographic profile of each community that might be affected by the development of the proposed Great Whale River hydroelectric complex. This profile should include possible future scenarios for demographic dynamics, making clear the limitations inherent in forecasting the demographic characteristics of each community.

376. The Proponent shall describe the economy of each community. Notwithstanding the present activities and future opportunities for employment and for the production of goods and services by Natives for their specific needs, this profile shall deal specifically with the evolution since the 1950s of the hunting, fishing, and gathering economy, as well as other traditional and commercial activities, taking into account the institutional structure introduced by the JBNQA. The Proponent shall draw a historic and current portrait of land use (1950-1975 and 1975-1990) in the area affected by the proposed project. Traditional and modern land use in the study area including Belcher Islands by Natives and non-Natives shall be clearly identified. Areas which are considered of particular interest to government bodies or other groups interested in the protection and development of the region (parks, reserves, conservation areas, sites or watercourses of interest for recreation or tourism, etc.) will be identified and justified with respect to the objectives of the Natives and non-Natives.

377. In addition, the Proponent shall study the influence of current transportation systems on the cost and availability of goods and services in the communities, shall identify present methods of transportation (on land and water) for accessing the territory and hence for gathering activities, and the degree to which they are used, and the costs of using the current system. Bodies of water in whole or in part used by Natives and non-Natives shall be identified, and a detailed description of the type and density of navigation on those waters shall be provided.

378. In addition to economic activities and transportation systems, the Proponent shall discuss the various ways the land is used and occupied (for subsistence, recreation, therapeutic or religious purposes, etc.) and shall study their relationship with the social structures and symbol systems of the Natives.

379. In so doing, and because the proposed project would take place within the framework of various land tenure systems established under the JBNQA and other laws that might apply, the Proponent shall indicate how the proposed project would take into account the land tenure systems applicable to the various land categories, including the land along Hudson Bay and Manitounuk Sound. Moreover, the Proponent shall describe in detail any changes the project could cause to the land tenure systems. To better define these changes, the Proponent shall provide the history of the land tenure system in the study area. This description will take into

account changes made both prior to and subsequent to the signing of the JBNQA in 1975.

380. Special attention shall be paid to the use of land along Manitounuk Sound and the Great Whale, Little Whale and Nastapoka river estuaries in relation to the distribution of resources, and to their use by the inhabitants of Kuujjuarapik and Whapmagoostui and other populations. This review shall outline the current situation and future prospects, taking into account the social structures, spiritual values, harvesting levels, and the importance of traditional foods. The Proponent shall seek to learn about the possible solutions and alternatives under consideration by the Natives themselves, should access to the territory be substantially modified.

381. The Proponent shall provide an overall assessment of current archaeological knowledge of the study area, including a detailed description of the methodology used in its program to identify potential archaeological sites. The assessment of the archaeological surveys shall include a description and an interpretation of archaeological sites that have already been excavated. These shall be interpreted in the context of the prehistory of Quebec and particularly Northern Quebec.

382. This archaeological and historical study will require close collaboration with numerous specialists, including those of the archaeology service of the Ministère des Affaires culturelles, the Cree Regional Authority and the Avataq Cultural Institute.

383. The Proponent shall study the quality of life of the communities, paying particular attention to mortality and morbidity, suicide rates, and all matters related to conjugal and family violence. The Proponent shall also describe the importance of traditional food sources and their availability in the diet of the communities in relation to food sources from the South. Furthermore, on the basis of available data, the Proponent shall establish a portrait of local health, using the principal diseases that provide indices of public health (in particular, diabetes, neoplasm and infectious diseases). The Proponent shall indicate the period over which the study of health-related problems in the region will take place. Finally, on the basis of available data, the Proponent shall discuss the extent and significance of substance abuse.

384. The Proponent shall pay particular attention to social organization and symbol systems. These include such aspects as relationship to the

land, social cohesion and dynamics (as opposed to the breakdown of the social organization), ties to other Native and non-Native communities, social identity, self-esteem, systems for explaining and accepting changes, common visions of the future, etc.

385. The Proponent shall analyse perceptions of the proposed project in the communities, in relation to their own visions of the future.

CHAPTER 4

PROJECT DESCRIPTION

GENERAL DESCRIPTION

401. The Proponent shall describe the entire Great Whale hydroelectric project, the access, housing, and communication infrastructures required, as well as the proposed collector system. This description shall include all relevant information required for a reasonable comparison among the various design and development variants and options for the project. A more detailed description of the selected project shall also be submitted.

402. In the *Preliminary Information* (Appendix 2), the Proponent described three possibilities for developing the hydroelectric complex. Variant 1 would include the development of the Great Whale River with diversion of the Nastapoka, Little Whale, and Boutin rivers, variant 2 would consist of developing the Great Whale River alone, and variant 3 would involve the separate development of the Great Whale and Little Whale rivers.

403. The Proponent had identified two sub-variants for variant 1, summarized in *Bulletin 5,* referred to here as sub-variants 1A and 1B. Sub-variant 1A would involve the downstream diversion of the Little Whale River, the diversion of the Boutin River, and the partial diversion of the Nastapoka River. Sub-variant 1B would involve of the upstream diversion of the Little Whale River and the partial diversion of the Nastapoka River.

404. Furthermore, the Proponent indicated in a letter addressed to the Provincial Administrator of the JBNQA dated February 21, 1992 (Appendix 2) that studies had led to the selection of a modification of sub-variant 1A, the optimized downstream diversion (1C), which excludes all diversion of the waters of the Nastapoka river basin. The middle and upper courses of the Little Whale River would also remain untouched (*Bulletin 5*, p.17).

405. The selected project therefore consists of the construction of three underground generating stations located on the Great Whale River (GB1, GB2, and GB3), each with its own reservoir, the creation of a control reservoir at Lac Bienville and the downstream diversion of the Little Whale River (40 km from its mouth) towards the GB1 reservoir. The selected project therefore excludes the Amichinatwayach and Saindon diversions, and is distinct from sub-variant 1A (downstream diversion) of variant 1 as described in *Bulletin 5*.

406. This selected project is the only project to be covered in detail by this impact study. Any return to other variants or sub-variants would require a separate authorization, preceded by a new EIS statement and a new public review.

407. The Proponent shall provide a detailed schedule for each phase of the construction of the selected project, clearly indicating all required flexibility. When appropriate, impacts related to possible variation in the schedule shall be evaluated. Any eventual authorization shall be based on a project with well defined dates. As described in paragraph 110, any significant change in the planned schedule could therefore justify a new public review by the review bodies or a new authorization by the administrators. The Proponent shall also indicate the costs of each project component.

JUSTIFICATION PROCESS FOR PROJECT SELECTION

408. The Proponent shall provide a comparative analysis of the environmental and economic impacts and technical arguments that have led to the choice of the selected project in such a way that the Committees and the Commissions can reasonably judge the validity of the choices made.

409. In so doing, the Proponent shall present an exhaustive comparative analysis of variants 1 and 2 and of the downstream (1A), upstream (1B) and optimized downstream diversion (1C) sub-variants (the selected project). The Proponent shall also explain why variant 3 was not considered further, and shall indicate the reasons why the Nastapoka diversion was excluded from the project, as well as the economic and environmental repercussions of this decision. The comparative analysis shall take into consideration the levels of impact buffering available at different levels of investment, and an assessment of the acceptability of

river diversions from a public policy perspective. Finally, the Proponent shall specify any future projects under consideration with regard to the Nastapoka River basin and discuss the environmental repercussions of these on the basin of the Little Whale River.

410. This comparative analysis shall indicate how the Proponent took the environmental and social objectives inherent in the concept of sustainable development into account in the optimization process. The design options for the project shall be analyzed in relation to their environmental and social costs and benefits, including those options which cost more to build and/or operate but which cause lesser environmental or social impacts. Also, the implications in economic, environmental and social terms of the diversion of a watercourse or the flooding of sensitive areas must be assessed, and the point at which such diversion or flooding becomes unacceptable for the Proponent must be clearly indicated.

411. The Proponent shall also justify the type of powerhouse proposed, and specifically shall discuss the merits and drawbacks of developing a run-of-the-river system on the Great Whale River, alone or in combination with one on the Little Whale River.

HYDROELECTRIC COMPLEX

412. The Proponent shall provide a detailed description of all work required for project construction including the following subjects:

1. time of the year, frequency and amplitude (maximum and minimum levels) of water level fluctuation ranges for all water bodies;
2. the maximum and minimum surface areas of reservoirs and forebays, with detailed maps, and residence time of water masses;
3. volume and description of debris in flooded areas, and their disposal methods;
4. flow rates (maximum, minimum and average) in the sections of the rivers affected, with detailed maps showing the areas affected and seasonal variations in water levels;
5. the types of dikes and dams, with their locations mapped;
6. maximum and minimum operating levels;
7. a description of the generating stations, with emphasis on the information required to understand and evaluate the project;
8. turbine types, maximum gross head and maximum quantity of turbined water;
9. the height and amount of backfill;

10. the dimensions and types of the spillways, with the number of gates, and the maximum capacity;
11. the dimensions, orientation and position of the tailrace canal and related structures;
12. diversion works;
13. a complete construction schedule based on each plausible set of hypotheses;
14. a schedule of costs for each phase of construction; and
15. the life span of the dams and dikes, the security factors used in their design, and their safety over the long term.

413. The information provided shall be sufficient to permit a full understanding of the operation of and the operational links between all reservoirs. It shall also include the frequency and intensity of the flows to the spillways for all reservoirs and clearly explain how they are to operate. The Proponent shall identify all permanent and temporary facilities.

Design options

414. The Proponent shall provide a description of each design option and its environmental repercussions, and shall explain the reasons for the choices made. The Proponent shall indicate whether any of the design options are to be revised or specified in greater detail before the commencement of the construction work. The following design options are based on impact studies submitted in the early 1980s. Any new design options that have been considered or are under consideration shall also be discussed.

415. Location of the GB1 generating station. The Proponent shall compare the economic, environmental and technical implications of locating the GB1 generating station in the Lebel, Domanchin or Great Whale river valleys.

416. Optimization of forebays (GB1, GB2, GB3 and Bienville). The Proponent shall describe the relationship between operating criteria for the forebays and the conditions necessary for managing fish habitats, and shall demonstrate how environmental considerations will affect the selection of minimum and maximum operating levels.

417. Spillways. The location of spillways shall take into account the design options for all structures in the proposed complex. In particular, a study shall be presented comparing the consequences of locating the GB1 spillway on Manitounuk Sound or on the Great Whale River. This study shall identify the main environmental, technical and economic issues related to both options, with emphasis on (a) maintaining controlled flow in the river, and (b) managing water levels in this area.

418. Load factors. The Proponent shall define the principal consequences related to the choice of load factor for the selected project. The Proponent shall devote particular attention to effects on ice conditions and the freshwater/ saltwater mix in Manitounuk Sound, as well as to the chemical, sedimentological, and biological impacts of modifications to circulation and exchange mechanisms.

419. GB1 generating station tailrace canal. In preliminary studies of the Great Whale complex in the early 1980s, the Proponent stated that the exchange of fresh water and salt water in Manitounuk Sound would depend on the location and geometry of the GB1 generating station tailrace canal as well as its vertical and horizontal positioning. The design of the tailrace canal thus requires environmental optimization, based on a profound understanding of the physical, chemical, sedimentological and biological oceanography of Manitounuk Sound. Technical documentation explaining the range of plausible scenarios with regard to tailrace design must be provided. The Proponent shall discuss the hydraulic and environmental criteria that have been used to demonstrate the relationship between tailrace design and environmental objectives. This analysis shall also take into account studies on the formation, break-up, and composition of the ice, and of polynyas. The Proponent shall pay particular attention to the choice of dimensions and shape of the tailrace canal, its horizontal and vertical position in relation to sea level and to pycnocline in Manitounuk Sound, and the rate of discharge into the local marine environment. Special attention shall be paid to the following environmental considerations: stratification density, local erosion, turbidity, sedimentology, primary production, ice conditions and the destruction of eelgrass beds and benthic organisms. In addition, consideration shall be given to the impact of the design of the tailrace canal on Native use of Manitounuk Sound. The Proponent shall also pay particular attention to blasting requirements for the various tailrace designs under study. The criteria for the use of explosives shall be established and justified, and detailed control procedures shall be presented. The Proponent shall formulate a formal blasting protocol that indicates what

level of collateral damage is acceptable and prescribes under what conditions the blasting program shall be suspended and reconsidered.

420. Protection of Lac Kakupis. The Proponent shall study the possibility of protecting Lac Kakupis completely, for instance by raising water levels in Lac Elizabeth so as to channel the diverted waters into the Rivière Coats. Problems related to dredging the shallows shall also be considered.

421. The Bienville reservoir. The Proponent shall report on studies concerning the maximal dimensions of the Bienville reservoir, as mentioned in the information provided by the Proponent. The possibility of modifying the dikes and limiting the extent of the flooded areas in the region near Lac Bienville shall also be taken into account. In this regard, the advantages of reducing flooding in the Lac Bienville region and the disadvantages of raising water levels in the GB3 and Paimpont regions shall be compared.

ACCESS ROADS, HOUSING, AIRPORTS AND COMMUNICATION INFRASTRUCTURES

422. The term "access roads" refers to all roads, including permanent and temporary secondary roads that would allow access to the territory and to the various elements of the hydroelectric complex. Similarly, all airports required for project construction and for subsequent electricity production shall also be studied, as well as all marine installations. "Housing" refers to the camps and villages required for the project. Where applicable, technical information requested in this section shall also be provided for the hydroelectric installations.

423. The needs of the Proponent concerning all aspects of the proposed project shall be identified as precisely as possible in order to avoid the need to request the amendment of any authorization that might be issued. It is understood that certain details may not be available at this time. These may be submitted later, depending on the conditions included in any authorization that may be issued. However, for each component, it is important to indicate in the study the location of the installations, their scope, all site preparation, required design criteria and the possibilities of use for other purposes once the work is completed.

424. The Proponent shall describe the ancillary installations required for construction of the complex. The Proponent shall indicate whether they will be permanent or temporary and whether they will be used for any other purposes.

425. Special attention is to be paid to the setting up of camps, the construction of villages and airport infrastructures, the use of borrow pits, the construction of access roads, the use and construction of wharfs, if necessary, and the installation of waste disposal sites or industrial facilities that might discharge contaminants into the environment. In this regard, the Proponent shall also, whenever possible, identify and quantify the use and production of dangerous products and waste generated by the project.

426. The Proponent shall present plans to manage all hazardous wastes that are generated as a result of the proposed project. The Proponent shall also indicate the method to be used to recycle other types of waste.

427. The Proponent shall present one or more scenarios combining roads and energy transportation lines in the same corridor. Technical, economical, social, biophysical and aesthetic advantages of these scenarios shall be discussed.

428. The Proponent shall also specify and justify the selection of the optimal site for the GB1 airport, taking into account the needs of the Cree and Inuit communities as well as of the Proponent. The Proponent shall prepare a detailed comparative evaluation of the following scenarios:

- improving the runway, existing infrastructures and support services at Kuujjuarapik/Whapmagoostui;

- establishing an airport at an intermediate site between GB1 and Kuujjuarapik/Whapmagoostui, whether on the coast or further inland to serve both locations. The distinction between Category I and II lands should not be interpreted as an absolute restriction in terms of the site selection;

- building a runway next to the GB1 station construction site.

Access roads

429. The Proponent shall describe the various access roads and corridors under consideration and indicate whether some will be modified before specific approvals are sought. The Proponent shall also justify both the study area and the routes and corridors retained, and shall clearly highlight the concerns and preferences stated during the consultation hearings. In this regard, a photographic file of ecologically sensitive areas and a map of the routes themselves shall be provided to facilitate review. The Proponent shall detail the environmental safeguards it proposes to follow and justify them whenever they differ from provincial and federal standards.

430. The Proponent shall define the program for operating the borrow pits required for the proposed project. The Proponent shall also specify the standards for their location in relation to roads, watercourses, wildlife areas and the boundaries of future reservoirs, observing relevant regulations and characteristics of the environment. The Proponent shall demonstrate how the use of materials from borrow pits has been optimized, and shall specify plans for restoring them once extraction is complete. The Proponent shall locate and map all planned facilities, specifying access roads, available materials, the areas involved and the volumes of material required. The Proponent shall also take maintenance requirements for the project into account.

431. North-south access (LG2/Fagnant/GB1) and east-west access (Fagnant-Bienville). The Proponent shall discuss the technical, economic and environmental justification for selection of the proposed route and shall re-examine the sub-variants in the Preliminary Information.

432. GB1/Kuujjuarapik/Whapmagoostui branch road. The Proponent shall propose routes to link the GB1 construction site to Kuujjuarapik/Whapmagoostui and shall present a comparative evaluation of coastal and inland routes. This evaluation shall take into account the different airport sites under study, as well as the results of a study of the cumulative impacts of the coastal corridor.

433. The Proponent shall demonstrate how the chosen corridors will minimize the impacts on Category I lands; suggest alternative routes in areas where highly sensitive watercourses are crossed (e.g., spawning beds); justify all winter routes; indicate how the road design takes permafrost into account; identify the sections of the road that are to be

paved, specifying the reasons, the views of the affected populations, the associated costs and environmental effects; identify areas of special interest (panoramic sites, access to a resource, traditional use by Natives, cultural or sacred sites, etc.) and indicate how the routes selected take into account protection or restoration measures; identify the emergency measures needed to cope with accidental spills of petroleum or hazardous products; describe these measures in detail, including the anticipated intervention time and environmental risks and the contingency arrangements made to secure decontamination facilities and/or permanent storage sites in southern Quebec.

434. The Proponent shall also provide the above-mentioned information for the secondary, temporary or permanent roads that lead to dikes, villages and camps or other installations needed for the construction of the infrastructures. The Proponent shall describe the technical characteristics and general road construction standards for the various road sections, including the technical components justifying the choice of the existing route; the length; width of the right of way, the road itself and the shoulders; standards for curbs, slopes, backfill and excavations, speed limit, and load capacity; and gradation of materials (particularly in the case of environments containing organic deposits likely to contain permanent ice lenses).

435. The Proponent shall describe the principal work to be completed during the various pre-construction, construction and maintenance phases, including land clearing and disposal of wood; clearing of organic materials and disposal methods; rock excavation; shaping of the road, spreading and compacting of materials; service infrastructures (service stations, maintenance centres, parking areas); special techniques and precautions to be taken in permafrost areas; road signs concerning safety and directions; maintenance and repair of the pavement, shoulders, ditches, bridges and culverts; and use of dust-control products and de-icers.

436. The Proponent shall describe the legal status of new access infrastructures during the construction of the proposed Great Whale River hydroelectric complex. The following, in particular, should be discussed: shall access roads be public or private and on what basis will this decision be taken? The Proponent shall assess the rationale for establishing a control system similar to that put in place by the Société d'Énergie de la Baie James during the first phase of construction at James Bay; who shall provide maintenance and information services for access roads, including the installation of rest areas, waste collection, snow removal, etc.?; who

shall be responsible for road safety? The Proponent shall describe in the impact statement any agreement reached with other parties regarding the status and maintenance of access roads, and report on consultations held on the subject.

437. The Proponent shall identify the required infrastructures for the construction and specify the roads or sections of roads that can be used as winter routes.

438. Works such as the construction of bridges, the installation of culverts, and transport by ferry shall be described as accurately as possible, clearly identifying alternatives.

439. The Proponent shall certify that such infrastructures comply in particular with the *Règlement sur les normes d'intervention dans les forêts du domaine public* (RRQ ch.F-4.1 R.1.001), especially with regard to narrowing watercourses and maintaining their navigability.

440. In planning the work period and sites, the Proponent shall take steps to ensure that the movement and especially the spawning of fish are not affected.

441. The Proponent shall indicate which access roads will be maintained or reused at the end of the project, and specify the future status of infrastructures used to cross watercourses. The Proponent shall describe the proposed bridges and the size of clearings and earthworks planned for each side of any watercourse where a bridge will be built. The temporary structures required to approach and cross large watercourses shall also be described. Where necessary, the Proponent shall describe the infrastructures required to maintain user access to watercourses.

442. The Proponent shall explain its choice of culverts and discuss the advantages and disadvantages of the various types of culverts available. Regarding their installation, the Proponent shall indicate the standards related to the slope permitted, the depth and the degree of overlapping in relation to the bed of the watercourse. All main culverts to be installed on permanent streams shall be listed and described in order to facilitate the application of regulations and monitoring operations.

Housing

443. The Proponent shall describe the housing facilities it will require and the planned organization of the construction site with respect to worker movements outside the camps, on-site safety measures, etc. The Proponent shall also indicate how the consumption of alcoholic beverages and the use of illegal drugs will be controlled.

444. The Proponent must indicate the exact location of each camp and the relative location with respect to other users of the territory. The Proponent shall submit development projects for these facilities, including their capacities and periods of use.

445. The development projects for each camp must include descriptions of drinking water supply source, method of managing wastewater and discharge areas, location and operating conditions of the solid waste disposal site, power supply (generator capacities, location, etc.), and management of any other installations (including fuel storage depots) required for the camps to function properly.

446. Several camps will be installed in open areas, favourable to heavy or off-road vehicle traffic. Since these environments are especially fragile, the Proponent shall indicate what measures would be taken to avoid disturbing them. The Proponent shall give special attention to the protection of riparian and aquatic habitats and sites of cultural or religious significance.

447. The Proponent shall also indicate whether some of the camps will become permanent or be given to various local parties interested in reusing them.

Airports

448. This section applies to all permanent and temporary airports, as well as to all seaplane and helicopter bases required for the project. It concerns activities related to the construction, operation, maintenance and closure of these infrastructures, as well as the restoration of the sites used. The Proponent shall present a list of potential airport sites and shall assess positive and negative attributes for each site.

449. The comparative analysis shall take into account the needs of other local and regional intervenors, to be identified during consultations with the communities concerned. The quality of air service available during construction work must be evaluated and the clientele that will use the facilities shall be described.

450. The Proponent shall discuss the biophysical and social constraints involved (topography, meteorology, threat to birds and other wildlife). The Proponent shall indicate the reasons for selecting the site, and the take-off and landing paths, and shall justify the rejection of other sites or paths. Potential sites for future camps and other infrastructures relating to the complex shall be indicated. The sites accepted shall be the subject of a detailed review.

451. For each permanent or temporary airport site the Proponent shall provide the technical information necessary to predict the environmental impacts, namely characteristics of main flight paths, runways, terminals, landing docks, hangars and other buildings, as well as of the navigational equipment; access roads, including a presentation of alternate routes; sources of electrical supply; a plan of the runway drainage system; borrow pit materials required, specifying location, surface area, volumes, and types; a fire protection system plan; an explanation of the proposed plane de-icing process and the containment of the substances used. The Proponent shall also provide: the location and description of fuel tanks and containment systems, draining and safety measures and the contingency arrangements made to secure decontamination or disposal facilities in southern Quebec in the event of a spill; a description of the proposed construction methods and the maintenance work and equipment required; results of archaeological digs; a description and location of the drinking water supply system, and the wastewater and solid waste disposal system; an estimate of the duration, frequency (day and night) and extent of use of the proposed infrastructures, and the amount of cargo and number of passengers passing through them; a summary of the constraints which may ensue from these infrastructures; a description of the manpower required for the construction and operation phases; and a work schedule.

452. The evaluation of the choice of an airport serving GB1 and Kuujjuarapik/Whapmagoostui has been described in paragraph 428. This evaluation shall be based on consultations with the parties involved, and the results of these consultations shall be presented as an integral part of the impact statement. Concerns regarding the safety of the existing

runway at Kuujjuarapik/Whapmagoostui shall also be addressed. Planning for these structures will extend over a period of at least twenty-five years.

453. The Proponent shall discuss the various alternatives considered for an airport between GB2 and GB3 and other airports. The sites selected by the Proponent shall be examined in detail. The Proponent shall identify and justify its needs as well as the needs of other interested parties, and shall meet the specific requirements of these guidelines.

454. The Proponent shall identify and justify its needs for temporary airports. In addition, the Proponent shall study transportation by floatplane and the installations and equipment required.

455. The Proponent shall also explain how the engineering work in the area of the diversions or related to control structures may affect the use of temporary winter runways. If runways are required on dry land, the Proponent must justify them.

456. With regard to a proposed runway at Lac Fagnant, the Proponent shall pay particular attention to the biophysical assessment of the site and the protective measures that would be taken to reduce disturbances to the natural environment to a strict minimum and to protect the sector in general. The Proponent shall also evaluate the possibility of using other sites and of using only permanent sites. The Proponent shall also indicate the probability of requesting approval for making these temporary installations permanent.

Communication infrastructures

457. The Proponent shall specify the scope and location of any communication and telecommunications systems required by the proposed project (transmission towers, access roads, energy sources, etc.).

COLLECTOR SYSTEM

458. The Proponent shall identify several corridors within the study areas in a logical and verifiable manner so that a preferred corridor or corridors may be selected. When this first step has been completed, a second set of guidelines dealing with the choice of a preferred route within the accepted corridor shall be sent to the Proponent.

459. In theory, the collector system should require as many corridors as there are lines; in practice, one corridor can sometimes accommodate two lines and even a road. The Proponent shall plan to combine the two lines linking the GB1 generating station to the Radisson station. The Proponent shall also indicate how it optimized the choice of distribution corridors and on what basis this optimization was based, describing any possibility of combining both roads and distribution corridors. Lastly, the Proponent shall explain how land use by native peoples was considered in preparing routes for the lines, referring in particular to the JBNQA and to consultations with concerned parties.

460. The Proponent shall provide the technical characteristics of the construction of the lines and, when applicable, the proposed switching stations or modifications to existing stations. Particular emphasis shall be placed on the characteristics necessary for analysing the choice of corridors. The Proponent shall present the technical constraints related to the collector system, and shall also take into account the transportation and accommodation infrastructures required for the project.

461. The Proponent shall specify the design criteria related to the project, as well as all information concerning technical construction methods that could influence the choice of corridors and allow the planning to be understood. The Proponent shall also specify the details for execution of the project according to the updated construction schedule, as well as the margin of manoeuvre.

462. The Proponent shall discuss the project's flexibility, in particular by demonstrating how reliability criteria justified the replacement of the 735-kV line that was initially planned with two 315-kV lines in the western part of the territory. The Proponent shall explain the choice of using a double-circuit 315-kV line between GB1 and Radisson and a single-circuit line between GB2 or GB3 and the Chissibi substation. The Proponent shall also explain how the options being studied, such as the harnessing of the Little Whale River, could modify the capacity of the complex and the design of the distribution system. The Proponent shall also specify the technical and economic implications of transmitting the energy produced at GB2 and GB3 elsewhere than through the Chissibi substation by connecting GB1 to LG2 or by going further east through the Tilly station. The modifications to be made to the Chissibi and Radisson stations shall be described.

463. The Proponent shall also address the implications of the proposed project with respect to the need to construct a 14th transmission line.

OTHER PARTIES INVOLVED IN THE PROJECT

464. The Proponent shall explain in what ways other public bodies responsible for regional development are involved in the project. For example, it shall specify the role of the ministère des Transports du Québec concerning the Kuujjuarapik/Whapmagoostui airport and the future maintenance of access roads, the role of the MLCP concerning the exploitation of wildlife, that of Transport Canada concerning navigable waters, and that of those bodies with jurisdiction over fish habitats and marine environment.

LOCAL EMPLOYMENT

465. For each phase of the project, including its operation, the Proponent shall identify the major activities at each construction site and provide a profile of the work force and working schedules required for each of these activities.

SYNTHESIS AND OVERVIEW

466. The Proponent shall end this chapter with a synthesis and overview of the selected project and the design options for the complex, the infrastructures and the collector system. The Proponent shall describe the various components of each variant and alternative (number of dikes, installed capacity, length of roads, work schedule, etc.) in order to give a comprehensive portrait of the selected project.

CHAPTER 5

IMPACTS OF THE PROJECT

INTRODUCTION

501. The Proponent shall evaluate the impacts of the proposed project by establishing a relationship between the description of the environment (Chapter 3) and that of the proposed project (Chapter 4). The Proponent shall identify the nature, intensity, and rate, as well as the temporal and spatial scope, of the environmental impacts. The Proponent shall evaluate the impacts of the proposed project itself on the ecosystems and human societies, and also its cumulative effects in combination with other activities in the affected region. In addition, the Proponent shall take into account the fact that, depending on the component under consideration, the effects of the proposed project could extend far beyond the project region and the construction period.

502. The environmental components selected for impact analysis shall be the valued ecosystem components identified by the Proponent in the environmental description required in Chapter 3.

503. In analysing each of the proposed project's effects, the Proponent shall take into account its frequency, impact, irreversibility, duration and recurrence, as well as the proportion of any resource or population (human, fauna, flora) that would be affected, the possibility of restoring the ecosystem and the time that would be required. The Proponent shall thus be required to provide an analysis and sufficient information to permit specialists in each field to fully understand and evaluate the conclusions.

504. In order to avoid the reductionist and compartmentalizing tendencies of an encyclopedic approach, the impacts of the proposed project on the various components of the environment shall be evaluated in terms of five fundamental issues:

1) health;
2) access to the territory;
3) availability of resources;

4) social cohesion;
5) respect for values.

505. Furthermore, the combined and cumulative effects of very different types of impacts on certain elements of the ecosystems shall be evaluated. These cumulative impacts, though more complex, do not differ in nature from other environmental impacts. As regards the source of the impacts, the Proponent shall take into consideration not only the various elements of the proposed complex but those of other projects as well, specifically including the La Grande, Churchill-Nelson and Conawapa complexes, as noted in Chapter 1.

HEALTH

Definition and approach

506. The notion of 'health' here is meant to include the current equilibrium of each ecosystem. Taking the descriptions required in Chapter 3 as the basis of an overview of the current state of health of both the natural and human environments, the Proponent shall evaluate any changes to this state of health that might occur as a result of the proposed project.

Specific questions

507. The study shall evaluate current and future states of ecosystem health and, in particular:

1. the diversity of flora and the factors which might disrupt it;
2. the abundance, distribution, and density of species of fauna, and the factors which limit these characteristics; in particular, in the relevant cases, the rates and causes of mortality and morbidity, including contamination and destruction of habitat;
3. the changing human populations and their reactions to disruptions related to development; and
4. for the human populations, the current state of individual, collective, physiological and psychological health, paying particular attention to diseases that serve as indicators of changes in health; and shall attempt to identify the causes. The evaluation shall take into account conceptions on the part of the affected populations with regard to their current health and to the impacts the proposed project would have on their health. It shall also take into account the local health services (both care and prevention) and, specifically, community resources.

508. The Proponent shall study the possibility that intervention in the territory may benefit or harm certain species. The Proponent shall examine any imbalance that might arise with respect to the current situation and shall evaluate them with respect to their duration and geographic scope. To this end the Proponent shall study, in particular, the pressures that human populations bring to bear on wildlife and shall relate this to the environmental stresses that might arise from the proposed project. In the analysis of these pressures, the following factors shall specifically be taken into account: demographic growth of the Native communities, increased access routes and improvements in transportation, increase in the number of sports hunters and fishermen, economic development of the region, poaching and over-exploitation, and the cumulative effects of these factors.

Food

509. The Proponent shall assess the impacts of dietary changes that would result from the proposed project on the health of living beings, and shall study, among other issues, the increase or decrease in the quantity and quality of available food resources (due to the reduction of the territory, increased difficulty or ease of access, contamination by mercury or other pollutants, etc.).

510. The Proponent shall also indicate how the percentage of food derived from hunting, fishing and gathering in relation to store-bought food could change as a result of changes in their relative costs and in food quality, specifically vitamin and protein content, resulting from the proposed project. This study shall, of course, be adjusted to take into account the dietary and physiological needs of Northern inhabitants, and particularly those of hunters.

511. Finally, the Proponent shall examine the effects of the proposed project on cultural aspects of diet: the difficulty or ease with which dietary customs can be modified; social ties created by activities involving the production and consumption of food; spiritual, dietary, or other values accorded to certain edible species of animals and plants; and all other relevant considerations.

Mercury

512. The Proponent shall undertake a state-of-the-art study of mercury contamination, evaluating the risks such contamination poses to the territory's wildlife and to human populations. The following paragraphs specify the principal requirements of this study. The Proponent shall also evaluate the nature and extent of the affected populations' fear of contamination and the consequences thereof, especially with respect to their dietary choices.

1. The Proponent shall review all relevant scientific information as well as the available reference data for the region of the proposed Great Whale River hydroelectric complex in order to predict mercury contamination of fish in the reservoirs and forebays of the proposed complex or of any other sector that might be affected.
2. The Proponent shall take into account any research programs carried out elsewhere on biogeochemical mercury cycles, and shall determine their applicability to the reservoirs planned for the proposed project.
3. The Proponent shall discuss the passage of fish through the turbines and the incidence of mercury contamination in downstream fish populations, in particular with respect to recruitment and potential toxicological effects. The Proponent shall also address contamination of crustaceans, molluscs, marine mammals (especially belugas), piscivorous birds (migratory and non-migratory) and waterfowl. The extent and duration of this contamination shall also be determined, taking into account all sources of leachate (soil, vegetation, etc.) as well as baseline data on distribution of this type of contamination.
4. As for cumulative impacts, the Proponent shall make use of data from the La Grande complex, and shall obtain data from the proponents of other projects (e.g. Churchill-Nelson and Conawapa).
5. With regard to Manitounuk Sound and Hudson Bay, the Proponent shall address the issue of the transfer and bioaccumulation of methylmercury up the food chain, from plankton and invertebrates to marine mammals, with respect to the design options under consideration for the tailrace canal, emphasizing those resources which are likely to be consumed by the human population.
6. The Proponent shall also evaluate the impacts of the proposed project with regard to the increase in human exposure to methylmercury. The following issues shall be clearly addressed:
    a. an evaluation of exposure levels and their distribution over time with respect to the various hypotheses concerning methylmercury bioaccumulation. These hypotheses and the ecological basis on which they are founded shall be clearly specified;

b. the pharmacokinetic behaviour of methylmercury in humans, including the selection of models linking consumption to indicators of body burden (in blood and hair);
c. the neurotoxicity of methylmercury in humans (adults and children) for differing levels and durations of exposure, including the cumulative effects of long-term exposure; the neurotoxicity of methylmercury exposure *in utero* and in mother's milk, for different levels of exposure; and monitoring studies on the long-term effects of *in utero* exposure, taking into account the diet of the local population;
d. current epidemiological knowledge concerning exposure levels and risks similar to those expected in the context of hydroelectric development;
e. changes in human exposure levels since 1975 (distinguishing between villages and sex and age groups);
f. in light of the preceding information, future changes in the likely rates of exposure for different social groups and an evaluation of the risks to adult populations associated with this exposure, taking diet into account; and
g. a study of the type of measures that would be required to meet criteria for acceptable levels of human exposure, justifying the criteria employed in terms of public health.

7. Insofar as the accelerated bioaccumulation of methylmercury in fish and possibly in marine mammals would require restrictions on Native hunting and fishing activities or would raise concerns among the population regarding the toxic effects of methylmercury and its consequences, it will be necessary to address social and cultural issues such as changes in diet associated with the presence of methylmercury in the environment.
8. The Proponent shall review the experience of other communities affected by mercury contamination (both inside and outside Quebec) to determine potential social and cultural impacts. The following points shall be covered:
    1. the level of exposure, taking into account the demographic profile of Native communities and the territorial organization of fishing activities;
    2. the perception of risk by the various groups involved;
    3. the harvesting of fish, marine mammals, and avifauna and the distribution and consumption of this harvest, taking into account knowledge that emerges from the study of mercury exposure among the population; and
    4. experience in controlling exposure among pregnant women and women of child-bearing age.

Safety

513. The Proponent shall examine all factors that could compromise or improve safety conditions within the territory, including those that emerge from the Proponent's own research and those that are brought up by the inhabitants of the region. The following factors in particular shall be addressed:

1. **Works.** The Proponent shall study any possible dangers to users of the territory resulting from construction, start-up and operation of the works, no matter what the origin of these dangers may be (seismicity, human error, modification of river flow, changes in reservoir water levels, explosives, hazardous wastes and others). In the case of seismicity, the Proponent shall take into consideration the cumulative risks arising from the impoundment of other reservoirs.

2. **Fires.** The Proponent shall study fire hazards related to construction and operation of the works and to increased human presence in the territory. In particular, reference shall be made to fires that occurred at the La Grande complex, and the consequences of an increased number of forest fires in the region shall be evaluated.

3. **Roads.** The Proponent shall study the risk of road accidents for wildlife as well as for humans.

4. **Waterways.** The Proponent shall study the dangers in crossing waterways in all seasons, particularly with regard to the effects of the tailrace canal on Manitounuk Sound.

Other issues

514. Other contaminants. Given the effects of heavy metals on the food chain, the Proponent shall also determine the current and anticipated concentrations of contaminants such as lead, cadmium, copper, arsenic and zinc in the reservoirs, food sources and potable water, particularly that resulting from the melting of permafrost and from inundation. The Proponent shall also consider the cumulative burden of heavy metals in Hudson Bay resulting from the proposed project in combination with other development projects.

515. Potable water. The Proponent shall clearly identify every watercourse that will be directly or indirectly affected by the project, and shall evaluate the impact of the proposed project on potability, chemical composition and physical characteristics (appearance, taste, odour). The Proponent shall also evaluate the impact of the cutting off of the Great Whale River on the potable water supply in the communities of Kuujjuarapik and Whapmagoostui.

516. Wastewater and solid waste disposal. In addition to evaluating the effects of the Proponent's own wastewater and solid waste treatment facilities, the Proponent shall examine the potential consequences of the proposed project on municipal infrastructures with respect to wastewater and the treatment of solid wastes, specifically in the communities of Kuujjuarapik and Whapmagoostui.

517. Electromagnetic fields. The Proponent shall evaluate health hazards to humans, animals and vegetation resulting from the electromagnetic fields induced by the transmission lines of the collector system. The Proponent shall pay particular attention to the possible cumulative effects of these transmission lines.

518. Stress and quality of life. The Proponent shall examine in what ways the proposed project could increase or decrease irritants (noise, dust, theft of equipment and other goods) and the risk of accidents (seismic activity, mass movements, modification of ice conditions, roads, dams). With regard to human beings, the Proponent shall in particular examine its effects on levels of fear and confidence (e.g., with respect to resources, culture, identity and control over the environment), insofar as the sense of alienation or belonging might affect health.

519. Greenhouse effect. The Proponent shall evaluate possible methane (CH_4) and carbon dioxide (CO_2) emissions from existing and planned reservoirs. The volume of the biomass involved and its rate of decomposition shall be estimated, and other areas that may serve as controls shall be identified. Other atmospheric phenomena related to the greenhouse effect, in particular the loss of photosynthetic activity in areas which are to be inundated, shall also be considered.

ACCESS TO THE TERRITORY

Definition and approach

520. In order to evaluate the free movement of all species inhabiting the territory, the Proponent shall inventory and map the land and water routes (including streams, rivers, lakes, estuaries, shorelines and Hudson Bay) and the aerial routes that are currently used, or could potentially be used, and which could be affected by the proposed Great Whale River hydroelectric complex. The seasons during which different movement patterns occur, and the reasons why, shall be particularly taken into consideration. With respect to wildlife, particular attention shall be paid to the movement of beluga populations and the corridors used by caribou. With respect to the human population, the Proponent shall also identify the methods of transportation employed (snowmobiles, canoes, various types of boats, ATVs [all-terrain vehicles], automobiles, trucks, helicopters, airplanes) and their costs. In addition, the Proponent shall describe the existing conditions governing the movement between the territory and neighbouring regions. The Proponent shall also consider the opinions of the inhabitants with regard to conditions of movement, as well as any fears they may express concerning the new conditions that would result from the proposed project.

521. In addition, the Proponent shall identify and map watercourses or sections of watercourses that would be lost and new watercourses that would be created, and shall indicate how these changes would modify access to the territory. For land routes, the Proponent shall identify and map the current network and shall describe the routes that would disappear due to the project, routes that would be created, and transformations to the territory that would be caused by the creation of these access routes. In all these cases, the degree to which accessibility would be reduced or increased as a result of the proposed project shall be evaluated. The Proponent shall thereby analyze how these access roads would transform the territory, and the effects these changes might have on the movement of living beings.

522. The Proponent shall evaluate the impact of the power transmission corridors planned for the collector system on the movement of humans and animals in the territory. In the same way, the impact of other infrastructures on human and animal movement shall also be studied. Finally, the Proponent shall evaluate the degree to which local inhabitants

may change their mobility patterns in the territory because of fears related to the safety of project facilities.

Specific questions

523. With regard to river and maritime routes, the Proponent shall describe possible modifications to their use by fish, marine mammals, birds and humans. This description shall include a study of the following phenomena to determine how they could hinder the mobility of humans and animals:

1. erosion and sedimentation in the GB1, GB2 and GB3 reservoirs caused by impoundment, as well as such changes in rivers and estuaries due to changes in flow. Erosion and land subsidence linked to the melting of permafrost on the banks of reservoirs and modified rivers shall also be examined;
2. changes to rapids, and to portage trails which run alongside them;
3. modifications to tidal effects and to the movement of water masses in the estuaries;
4. bathymetric changes in the estuaries and in Manitounuk Sound, particularly in proximity to the tailrace canal;
5. ice conditions in the reservoirs and changes in the ice regime in rivers, estuaries, Manitounuk Sound and Hudson Bay, caused by changes in flow and by resulting changes in temperature;
6. temporary changes caused by reservoir impoundment and by tidal effects;
7. modifications to the local climate (precipitation, fog, temperature), including that of Hudson Bay, caused by the creation of the reservoirs of the proposed project and by the cumulative effects of these reservoirs together with those of other hydroelectric installations; and
8. the presence of debris and vegetation in the reservoirs and rivers.

524. The Proponent shall examine the navigability of affected waterways, taking particular account of the *Navigable Waters Protection Act*. In assessing circulation during construction and after the start-up of the proposed complex, the Proponent shall pay particular attention to Manitounuk Sound, the Bienville reservoir and to river estuaries, especially that of the Great Whale River. This estuary provides the only location where boats can berth at Kuujjuarapik/Whapmagoostui.

525. The Proponent shall analyze the obstacles and benefits resulting from the creation of new roads, as well as their contribution to the free movement of wildlife and humans in the territory. The Proponent shall

pay particular attention to the possibility of human access to caribou migration corridors. With regard to caribou migration, the Proponent shall also pay particular attention to the cumulative effects resulting from other installations in the northern areas of the Quebec-Labrador peninsula. The Proponent shall also address the phenomenon of erosion of organic soil caused by modifications to the natural flow regime and to land drainage, and by the creation of swamps.

526. The Proponent shall describe any new air-traffic conditions and shall evaluate their impact on the flyway of birds, in particular at Kuujjuarapik/Whapmagoostui during the construction period and following start-up, if appropriate. The effects of these conditions on human mobility shall also be evaluated.

527. The Proponent shall evaluate any changes to the cost of travel in the territory, as well as in distances to be covered in order to access various locations used by the human populations living in the territory. The study of the effects on transportation costs shall take into account the income of the users during and following construction of the proposed project, particularly for those whose activities in the territory regularly require them to travel.

528. Finally, the Proponent shall evaluate how the construction of access routes to the installations would contribute to the opening of the territory as a whole through the creation of transportation links with the rest of the continent. The Proponent shall also indicate the extent to which needs for access (both northward and southward) would be met and to which needs for isolation would be compromised (potential users, frequency, seasons, methods of transportation, reasons for use, changes in travel costs between the host region and the rest of the country), for each affected population. Again, collaboration with the communities of Kuujjuarapik and Whapmagoostui and analysis of other instances where territories were opened (including Chisasibi) are recommended. The Proponent shall be particularly attentive to the sense of identification with the territory on the part of both local populations and those of other regions.

AVAILABILITY OF RESOURCES

529. The Proponent shall present an overview of the resources in the territory, and then shall evaluate changes in the diversity and wealth of these animal and plant resources as well as in their use both by Natives (hunting, fishing, trapping, gathering) and non-Natives (sports hunting and

fishing). Special attention shall be paid to the territories located along Manitounuk Sound, to the region of Lac Bienville and to the Belcher Islands. Provisions of Subsection 4.4 of Appendix 1 to Section 4 of the JBNQA concerning an eight-mile corridor around the road between LG2 and Kuujjuarapik/Whapmagoostui shall be taken into consideration.

530. In addition, the Proponent shall estimate the future use of other resources in the territory (water, minerals, appeal of nature in general), by local communities and by the inhabitants of other regions for cultural purposes and for recreation, tourism, energy production and other purposes. The Proponent shall also consider the economic contribution of these resources, that is, the creation of revenues and especially of jobs (in outfitting, tourism, mining operations, etc.).

531. The Proponent shall describe and evaluate the positive and negative quantitative (extending as far as complete loss) and qualitative changes to habitats that could be caused by one or another element of the proposed project, or by their management.

532. With respect to flora, the Proponent shall indicate the land areas that would be lost and the impact of these losses on floral equilibrium, including losses in neighbouring regions. The positive or negative impacts of these losses on fauna shall also be studied.

533. In examining wildlife habitats, the Proponent shall pay particular attention to those species highly valued by the groups concerned, especially the beluga, caribou, fur-bearing animals and avifauna (particularly migratory birds).

534. Beluga. The Proponent shall evaluate the effects of the proposed project on the herd's reproductive cycle and, in terms of habitats, on calving areas and nurseries; in addition, on the basis of what is known about the ecology and distribution of marine mammals in the region, the Proponent shall assess the effects of changes in the ice regime and on physical, sedimentological, chemical and biological characteristics of the environment for each of the scenarios of the proposed project. In light of the present state of knowledge concerning this species, the Proponent shall also evaluate the differential effects of the diversion or non-diversion of the Little Whale River.

535. Caribou. In evaluating the impacts on caribou, the Proponent shall use all data already available as well as data to be collected by the

Proponent, including results obtained from studies carried out on the La Grande complex and similar projects. This information shall be used to assess the influence of hydroelectric developments on changes in habits and habitats during and after the construction of the proposed complex. The evaluation shall also take into consideration preferred areas of use and migration routes.

536. Fur-bearing animals. The Proponent shall describe the proposed project's impact on fur-bearing animals, the rate of capture and the distribution of the species mentioned in Chapter 3.

537. Avifauna. The Proponent shall evaluate the abundance, distribution and seasonal habits of bird species throughout the territory and shall evaluate the impact of habitat losses for these species, especially in the case of waterfowl and migratory birds. The Proponent shall describe changes in shoreline habitat following the impoundment of reservoirs, and shall estimate the significance of lost nesting, staging, feeding and rest areas for avifauna in general, but particularly for waterfowl and ptarmigan, whether that significance is related to hunting or to ornithological interest. The Proponent shall describe the present state of knowledge concerning the use by waterfowl of the east coast of Hudson Bay and Manitounuk Sound, paying special attention to species of interest to Native inhabitants, particularly eider duck, ptarmigan, Canada Goose, and Snow Goose.

538. River sections and reservoirs. Taking into account the areas that would be inundated and reservoir management policy, the Proponent shall describe changes to shoreline and shoreline habitat that would result from the impoundment of the GB1, GB2 and GB3 reservoirs and the Bienville reservoir. The duration of the reservoir impoundment period and changes in water levels shall be taken into consideration, and an evaluation shall be made of the anticipated extent of changes in erosion and sedimentation. The Proponent shall estimate the significance of losses to nesting, breeding, feeding and resting areas for avian species in general, and especially for waterfowl and ptarmigan, whether that significance is due to hunting or to ornithological interest. The Proponent shall also estimate the loss of habitat for land fauna and shall interpret the results in relation to the value of the riparian habitat for these species. The Proponent shall also estimate the effects on aquatic fauna in terms of quality of the modified habitats (inundated or emerged); changes in species makeup and biomass shall also be assessed.

539. In the case of river sections where flow is to increase or decrease, an evaluation shall be made of the effects of these changes on erosion, sedimentation, water quality and ice conditions, and on the phyto- and zooplanktonic and benthic communities that inhabit them. The Proponent shall evaluate the loss or gain of habitat in relation to the various flow level scenarios under consideration and to the creation of reservoirs.

540. The Proponent shall evaluate the impact of the creation of reservoirs on fish, particularly with regard to the following: changes in fish communities in the reservoirs, taking into account both operating criteria and spawning and egg maturation conditions; growth rates as a function of population dynamics; mortality, fertility and reproductive age; as well as natural variability in age-class representation. The same parameters shall be evaluated for fish populations subject to changes in flow. The Proponent shall also evaluate the risk of transfer of fish species from one drainage basin to another, or from one water body to another.

541. For all sectors affected by the proposed development, the Proponent shall indicate the area of vegetation that would be flooded and shall indicate the quantity of organic matter that would contribute to the release of methylmercury. In addition, for all sectors, the Proponent shall evaluate the area of peat bogs that would be floated and the consequences that would result.

542. The Lac Bienville region. Lac Bienville is an area of great importance to the region's wildlife. The amount of prime wildlife habitat lost would depend on the size of the reservoir created. The Proponent shall conduct a comparative analysis of loss of habitat and decrease in wildlife productivity for the entire region. In addition to the studies mentioned in the preceding paragraphs, the Proponent shall specifically study the effects of impoundment and of changes in water levels on waterfowl and caribou found in this area at different times of the year.

543. Estuaries. Flow changes in the estuaries would have an impact on the physical and biological environments. In this context, the Proponent shall evaluate the effects of the proposed project and, more specifically, shall:

1. predict the behaviour of the estuaries after the completion of the proposed project with regard to erosion, salinity patterns, freshwater plumes, changes in temperature and turbidity, transport and deposition

of sediment, bathymetry and physico-chemistry, using mathematical models;
2. evaluate habitat loss for fish and other marine organisms and predict possible changes in species makeup and the biomass. The Proponent shall present the effects of physical and physico-chemical changes on the ecology of fish larvae and on the recruitment of anadromous fish;
3. evaluate the influence of winter water conditions, including changes to freshwater plumes in coastal waters, on reproductive success and habitat availability for fish normally present in the estuaries in winter;
4. discuss the effect of changes in flow on the use of estuaries by marine mammals, particularly Little Whale River estuary, examining the effect of possible changes in temperature, bathymetry and availability of prey. Possibilities of replacement habitat shall also be examined, as well as the impact of these changes on the number and condition of these animals, particularly the beluga; and
5. evaluate the importance of the possible use of the GB1 spillway on the physical, chemical and ecosystemic components mentioned above.

544. Manitounuk Sound. Taking into account the increased freshwater supply in Manitounuk Sound, the Proponent shall evaluate its effect on tidal effects, ice cover, polynya zones and local bathymetric conditions. The Proponent shall indicate the implications of the different options being studied on sedimentology, primary production (including ice algae), shellfish, fish, waterfowl and marine mammals. The Proponent shall evaluate the anticipated impacts of the proposed project on anadromous fish, taking into account changes in the estuarine environment. To support these predictions, the Proponent shall present the mathematical models used to reproduce current and future conditions of these habitats, and shall justify the choice of models.

545. Hudson Bay and Belcher Islands. The environmental impact of the proposed project on the wildlife and marine resources of the Belcher Islands requires special attention on the part of the Proponent. Long-term changes to the marine environment that would result from the development of the proposed project shall be evaluated, as well as the effects on the following elements: marine currents, physical and chemical properties of the water, formation, movement and break-up of ice; and fish, birds, seals, beluga and other forms of marine life, as well as certain mammals such as the polar bear. The Proponent shall also examine cumulative effects on marine productivity of the various hydroelectric complexes on James Bay and Hudson Bay, and the possible impacts of changes in currents and freshwater supply in these bays.

546. Biodiversity. The Proponent shall pay particularly attention to the impact of the proposed project on rare, vulnerable, or threatened species, whether so identified by governments or by organizations working in this field. The Proponent shall evaluate the probability that certain species might be threatened or might disappear from a specific location or area. In doing so, the Proponent shall take into account any protected status already granted or under consideration, as well as agreements concluded between Canada and other countries with regard to certain species.

Exploitation of resources

547. The Proponent shall study expected changes resulting from the proposed project on the harvesting of fauna and plants, berries and other vegetation. The Proponent shall clearly identify the work that would take place on each trapline and shall also take into account the different categories of land established by the JBNQA.

548. In this study, the Proponent shall consider the entire territory to be occupied in a continuous fashion even if, for example, certain parts of the territory appear to be unoccupied at the time the studies are carried out. Replacement territories for traditional activities are to be considered in this context.

549. The Proponent shall evaluate the effect of the proposed project with regard to use of the territory by present or future Native or non-Native local populations for activities other than food production, such as recreation, education, the transmission of knowledge, rest, tourism, community and inter-community festivals, and others.

550. Moreover, the Proponent shall examine the effect of the proposed project on the current and potential state of sports fishing and hunting. The Proponent shall evaluate the availability of animal resources, not only for the inhabitants of the region, but also for users from the rest of Quebec or elsewhere. The study shall take into account the influx of sport fishermen and hunters during and after construction, whether they be workers or visitors to the region, particularly in the context of the opening of the communities of Kuujjuarapik and Whapmagoostui. Reference shall be made to the experience acquired in the James Bay region during and after the construction of the La Grande complex. The combined effects of opening the territory and modifying it in terms of area, availability and accessibility shall also be taken into account.

551. In addition, the Proponent shall examine the impacts that would result from the proposed project on tourism in the region, taking particular account of sites with a potential for sports or tourism, highly valued species, and rivers known for recreational or other activities. The Proponent shall evaluate the availability of these resources, not only for the members of local communities, but also for a wider population that identifies with the territory or shows interest in certain specific components of the environment.

552. The Proponent shall discuss in what way the proposed project is compatible with Native or non-Native plans for future development of the territory. For example, the Proponent shall examine the effects that would result from economic stimulation in the region (investment, employment structure, income, etc.). The Proponent shall in particular consider the future use of new products, the introduction of new technologies to process raw materials already in use, and the development of new markets. In short, the Proponent shall study the effects of the proposed project (including the construction of roads and airports) on regional development (outfitting, mines, etc.). The Proponent shall also examine the consequences of the proposed project on the availability of government services, the quality of air transport services, and the cost and availability of consumer products (the absence of competition shall be emphasized, when appropriate).

The project considered as a resource

553. The Proponent shall describe the economic spinoffs that would be derived from the sale and rental of goods and services on a local, regional and national basis. The Proponent shall explain how the proposed project would contribute to the economic development of all the communities in the region, and shall also examine the possible impacts on these same communities should the proposed project or some of its elements be abandoned.

554. The Proponent shall evaluate the impacts of the proposed project on the employment situation, locally as well as regionally and nationally. This evaluation should include the number and type of jobs that would be created; length of employment; training and experience acquired; as well as salaries for Native and non-Native workers from the region, from neighbouring towns and regions, and from the rest of Quebec. Furthermore, the hiring policy with regard to Native workers shall be specified.

555. The Proponent shall present a profile of workers to be hired in Native communities (age, sex, education, training, experience), and shall describe their possibilities for long-term employment during operation of the facilities. In addition, the Proponent shall specify both the type and duration of the jobs that Native workers would hold.

SOCIAL COHESION

556. Once again, making use of the descriptions required in Chapter 3, the Proponent shall describe how the proposed project would fit into the existing process of social change in the communities of northern Quebec. More specifically, the Proponent shall indicate what effect the proposed project would have on the extent, intensity and rate of the social change that has been underway since the 1950s, as a result of both internal or external factors.

557. The Proponent shall identify and evaluate the possible consequences of the proposed project on the social cohesion of Native communities in the territory. In particular, the Proponent shall consider the following aspects: the sense of autonomy, the boom-and-bust effect, population displacement, effects related to the opening of the region, the presence of migrant workers and the Native work force.

558. The Proponent shall study the risk of the boom-and-bust effect in Quebec and Native societies that might result from the proposed project. This disruption is related to large but temporary construction sites that are shut down abruptly. The Proponent shall indicate how extensive this effect might be, as well as the consequences that might follow.

559. Furthermore, the Proponent shall study and evaluate not only how the proposed project would modify access to the territory and to resources, but also what impact these modifications would have on the social organization of the communities. In particular, the Proponent shall examine the possible transformation of family relations and relations between the sexes and the generations due to changes in activities involving the harvesting and consumption of goods from the territory (for example, changes caused by mercury contamination). The Proponent shall also study changes affecting the relations between groups formed to carry out specific activities in the territory (hunting, fishing, weekend camping, etc.). The Proponent shall also examine possible changes in relations among the members of each community, particularly with regard to

relations involving the distribution of the population across the territory and the sharing of game.

560. The Proponent shall study the possibility that individuals or families would emigrate from one community to another after completion of the proposed project, and shall assess the impact of any such movement on Kuujjuarapik and Whapmagoostui, the communities most directly affected, as well as on others.

561. The Proponent shall also study the anticipated effect of the opening of the region and of the communities of Kuujjuarapik and Whapmagoostui. In this regard, the Proponent shall evaluate the medium and long-term social effects of interpenetration among regions that, until now, have remained isolated. With regard to the inhabitants of the North, the Proponent shall identify the elements of social life in general that are likely to resist or to be susceptible to change. In particular, the following factors shall be evaluated:

1. the social impacts of economic development (outfitting, tourism, mining, commerce, etc.);
2. impacts on Native employment;
3. the effects of easier access to the South, especially for youth;
4. the positive and negative effects of increased contact with the inhabitants of neighbouring regions, as well as with visitors who might travel to the region for one reason or another;
5. the effects of easier access to alcohol, solvents and drugs, particularly the possible increase in the rate of violent death and family and community violence;
6. the effects on the rights of Native people; and
7. the cumulative social effects of the proposed project, which would take place alongside the other sources of the social change affecting the populations of the region.

562. Each major component of the access infrastructures shall be examined (north-south and east-west roads, airports, etc.); the access routes shall also be evaluated as a whole, since their effects are likely to be cumulative. In the same way, the study shall include an analysis of the positive and negative effects that would result from a road connection between Kuujjuarapik/Whapmagoostui and the sites of any other development activity in the territory. In preparing this section, the Proponent shall work closely with the communities of Kuujjuarapik, Whapmagoostui and Chisasibi, and shall indicate the experience acquired following the opening of other communities in northern Quebec, on the

Lower North Shore or elsewhere in Canada. The Proponent shall also collaborate with the relevant organizations and governmental departments.

563. The Proponent shall examine the effects of increased Native presence in Quebec's Near and Middle North. The Proponent shall also analyze how the inhabitants of these regions would be affected by their participation or non-participation in the construction of the proposed project and in its future operation.

564. The Proponent shall study the impact of the presence of migrant workers in the territory during the construction period. Information shall be provided with regard to the anticipated number of workers, their place of origin, main characteristics, living and travelling conditions, work schedules and holidays, consumption habits and behaviour (including alcohol and drugs), sexuality (including epidemiological and social risk behaviour) and recreational activities, including hunting and fishing. The Proponent shall also determine the level of knowledge among these workers concerning Cree and Inuit history and culture, and concerning the various agreements signed by the Native people and the governments of Quebec and Canada. Moreover, the Proponent shall provide information on safety and health conditions for all workers at the sites. The Proponent shall also provide information on representations made by workers and their families with regard to the advantages and disadvantages of working in James Bay and on the probable impacts of their work on their skills and on their ability to find work or to be retrained after the project has been completed.

565. The Proponent shall evaluate the medium and long-term social effects of jobs created in the Native communities. To this end, the Proponent shall specifically study Native attitudes toward wage work, Native representations regarding employment in development projects, relations between Native and non-Native workers both on- and off-site, and problems encountered by Natives employed in the construction of such projects. For the study of these last two points, the Proponent shall draw upon the experience of the La Grande complex.

566. The Proponent shall complete the analysis of social effects by extending the exercise called for in paragraph 251 with an evaluation of the positive and negative effects of the construction or abandonment of the proposed project on the population of southern Quebec.

RESPECT FOR VALUES

Respect for culture

567. The Proponent shall evaluate the effects of the proposed project on the cultures of the Cree, Inuit and, in certain cases, the Naskapis and the people of the rest of Quebec, as well as on the cultural identity of these groups, paying particular attention to the following elements:

1. life-style, including dietary practices and consumption habits in general, methods of production and distribution of goods and services, artistic production, types of recreation, holidays and celebrations;
2. the Cree and Inuktitut languages and the teaching of other languages, particularly taking into account the increased presence of individuals who do not speak the Native languages;
3. the transmission of know-how and knowledge, given that the activities that encourage such teaching be modified;
4. spiritual ties with any living creatures, and the spiritual dimension of the use of the territory in which they live (rites, ceremonies), including, in some cases, those of the Naskapi;
5. burial sites and relations with ancestors (including for the Naskapi);
6. archaeological heritage. In this regard, the Proponent shall ensure that archaeological digs are carried out on the main development sites and areas proposed for the infrastructures (dams, dikes, reservoirs, roads, airports, etc.). The Proponent shall indicate the measures to be taken should archaeological remains be uncovered;
7. sites and phenomena valued for historical, aesthetic, or other reasons (which the Proponent shall identify), such as portage trails, ancient meeting places, sites where specific events occurred, areas of interest rendered accessible by the project, the Native concept of the continual flow of rivers; and
8. the sense of identification and, more specifically, the notions of belonging related to the territory, language, and cultural values, as well as the sense of responsibility toward the ecosystems.

Respect for laws and agreements

568. The Proponent shall indicate the degree to which the proposed project conforms to existing laws, institutions, and agreements, including:

1. the JBNQA and the Northeastern Quebec Agreement (Naskapi);
2. resolutions passed by the National Assembly of Quebec, including the 1985 resolution concerning Native people; and
3. international agreements (including the agreement on migratory birds).

Values with regard to the environment

569. The Proponent shall indicate how the proposed project would take account of Native, national, and international aspirations, both traditional and modern, within the framework of sustainable development. For example, the Proponent shall address:

1. the protection and safeguarding of ecosystems and species;
2. the preservation of landscapes considered to be unique or particularly representative;
3. the preservation of rare, vulnerable and endangered species (indicating on what basis they are so considered); and
4. biological and cultural diversity.

OVERVIEW AND SYNTHESIS OF IMPACTS

570. The Proponent shall draw up a table of the proposed project's anticipated effects, which shall enable the reader to easily take stock of all its impacts. This section shall provide an integrated synthesis of the proposed project's impacts on the environment, including cumulative impacts on Hudson Bay and the Belcher Islands. This synthesis shall clearly specify the consequences of the proposed project by grouping them according to the fundamental issues described above.

CHAPTER 6

MITIGATIVE AND COMPENSATORY MEASURES

GENERAL

601. The Proponent shall present mitigative measures for the impacts of the proposed project. The Proponent shall also identify the nature and scope of the residual impacts that will occur in spite of these measures and propose, where necessary, a program of compensatory measures.

602. It is essential that mitigative measures be planned in advance, and not be instituted reactively. Before construction work on the proposed project begins, the Proponent shall develop a proactive plan for mitigative and compensatory measures that would be implemented during the construction and operation phases of the complex.

603. A detailed description of the Proponent's policy concerning mitigation and compensation shall be presented, including its rationale and an analysis of mitigation and compensatory measures undertaken with respect to the La Grande projects. In particular, if funds have been set aside (whether as capital or as operating costs) for mitigation and compensation, the Proponent shall distinguish between funds which were destined for mitigation and for compensation, and shall explain how these figures were arrived at. The Proponent shall evaluate the effectiveness and efficiency of the mitigative and compensatory measures for the La Grande projects and shall report on the level of satisfaction of the affected populations with regard to those measures. The Proponent shall also refer to other projects in northern environments (Churchill, Churchill-Nelson, etc), as well as to relevant literature available, in order to demonstrate that the mitigative and compensatory measures proposed reflect the state of the art in the field.

604. Furthermore, the Proponent's policy concerning mitigation and compensation shall be compared with that of other major Canadian utilities that are undertaking hydroelectric development in a northern environment. The Proponent shall refer to other projects in northern

environments (Churchill Falls, Churchill-Nelson, etc.), as well as to the relevant literature available in order to demonstrate that the mitigative and compensatory measures proposed reflect the state of the art in this field, and are respectful of Native populations.

605. In keeping with the requirements outlined in paragraph 128, the Proponent shall consult with the Native populations and ascertain their needs with regard to developing mitigative and compensatory measures for the proposed project. A concrete mitigation and compensation program should reflect these consultations.

MITIGATIVE MEASURES

606. The objective of mitigative measures is to lessen or alleviate a project's negative environmental impacts. To this end, the Proponent shall present all such measures, as well as the preventive and corrective actions proposed during all phases of the proposed project. Particular attention shall be paid to minimizing the impacts on Category I and II lands.

607. The Proponent shall provide an indication of the costs, timing and mode of implementation of these mitigative measures, and shall identify the parties responsible for their implementation, as well as the contractual obligations of the contractors and sub-contractors hired to carry out specific measures.

608. The Proponent shall also report on the experience concerning the organization of remedial work activities and propose an institutional framework appropriate to the proposed project. The proposed institutional framework shall take into account the central role of Native peoples who will be affected by the proposed project.

609. The review of mitigative measures by the Proponent shall include, but not be limited to, the following aspects and general categories: health and well-being; safe access to land and resources; drinking water quality and supply and other municipal infrastructures; valued or sacred sites; socio-economic impacts; employment and contractual opportunities for Native peoples; hydrological management, restoration and project management.

HEALTH AND WELL-BEING

610. The Proponent shall identify the groups that would be most affected by the proposed project and shall consult with members of those communities to determine ways to reduce or eliminate any impacts on health and personal and community well-being.

611. The Proponent shall indicate how the collaborative work with existing health-care agencies will be established and shall ensure that community members (particularly those concerned with health-related matters) may participate in the decision-making process.

612. In the case of mercury, the Proponent shall suggest a social intervention strategy and shall identify the resources required to implement and periodically review it. In this context, the Proponent shall propose, among others, a strategy for ongoing dialogue and consultation between the Proponent and the affected population as well as those government agencies involved. The Proponent shall address problems of language or comprehension in implementing information programs for users of these resources.

SAFE ACCESS TO LAND AND RESOURCES

613. The Proponent shall indicate how the free movement of Native peoples will be maintained, should the proposed project be approved, in order to ensure access to the territories, including replacement of access routes for fishing, hunting and trapping during construction phases when access will be restricted; and the possibility of maintaining rivers, lakes and reservoirs as traditional transportation routes for Native peoples, both in summer and winter.

614. In addition, the Proponent shall indicate the specific measures to be taken to ensure that Native activities can be pursued in safety. Where waterways become partially or totally unsuitable for travel due to reduced or increased water flow, the Proponent shall specify remedial and compensatory measures to be implemented.

615. The Proponent shall examine the measures to be taken to limit negative impacts on migratory birds, considered as a resource for southern and northern populations.

DRINKING WATER AND OTHER MUNICIPAL INFRASTRUCTURES

616. The Proponent shall indicate how an acceptable and adequate drinking water source both in quality and supply for Kuujjuarapik/-Whapmagoostui will be ensured, in collaboration with these communities. In this regard, the Proponent shall present the various options and indicate the advantages and disadvantages of each one while describing the work required and the environmental impact. The Proponent shall also identify any other agencies involved and indicate the extent of the Proponent's participation in the implementation of the measure taken to guarantee that the communities will have a viable and sufficient source of drinking water to satisfy their current and future needs.

617. The Proponent shall also propose mitigative measures to be undertaken concerning other municipal infrastructures (e.g., solid waste and wastewater) that could be affected by the proposed project.

VALUED OR SACRED SITES

618. In consultation with the communities concerned, the Proponent shall identify the location of burial sites that could be disturbed by the proposed project, and shall design a program to deal with their possible relocation. In addition, the Proponent shall discuss measures to be undertaken for the preservation of historical, sacred, cultural, archaeological and natural sites and the recovery of materials. The Proponent shall also discuss the best way to use the results of various studies to enhance knowledge of the history and prehistory of the territory in order to ensure that this knowledge is made available to Native groups.

619. Measures the Proponent intends to undertake regarding the aesthetic and recreative enhancement of areas which may or may not be affected by construction work, including those used for hunting and fishing, shall be indicated. These measures shall include the possible deforestation of sectors to be flooded for purposes of aesthetics or wildlife management and/or the removal of wood residue after impoundment. The Proponent shall also examine the possibility of selecting corridor pathways in such a way that the power lines would be as little visible as possible from sites of special interest.

SOCIO-ECONOMIC IMPACTS, EMPLOYMENT AND CONTRACTUAL OPPORTUNITIES FOR NATIVE PEOPLES

620. The Proponent shall describe the most appropriate strategies for the development of education programs designed and carried out by Native peoples to heighten awareness of the proposed project's impacts, the social changes that may occur, and the mitigative measures that might be taken to minimize the impacts of the proposed project.

621. The Proponent shall outline policies concerning the employment of Native peoples and the use of Native enterprises by the Proponent and by contractors engaged for the construction and operation of the proposed project.

622. Measures the Proponent intends to take to ensure that a substantial number of Natives have employment opportunities and to ensure that Native enterprises are involved in the construction and operation of the proposed project shall be identified. This shall include but not be limited to: a clear policy concerning preferential employment and contractual allocations to Natives; the measures the Proponent intends to include in the tender documents to ensure that contractors hire Native workers and subcontract to Native enterprises; the number of jobs which the Proponent and contractors would guarantee to the Native population, both in the construction phase and in the operation of the proposed project; and an indication of the value of contracts which the Proponent and contractors would guarantee to Native enterprises.

623. The experience of the Proponent during the construction and operation of the La Grande project shall be presented, with emphasis on the effective participation of Native people in construction work and the value of and interest shown in training programs designed to develop local manpower for the long-term jobs that were created. The Proponent shall take into account the reports prepared by the James Bay Employers' Association.

624. Employment barriers to Natives shall be identified and specific corrective measures proposed. These barriers shall include but not be limited to the use of French in the workplace, restrictions resulting from collective agreements, employment regulations in the construction sector, and the training requirements of the Native population.

HYDROLOGICAL MANAGEMENT AND ECOSYSTEM MAINTENANCE

625. The Proponent shall discuss policies and commitments regarding the management and control of water levels in rivers where flows are to be decreased, in order to maintain viable ecosystems. The measures aimed at regulating or mitigating the effects of backflow and flooding along banks in areas where flows are to be increased shall also be discussed. A review of erosion control measures and other measures shall also be provided. The Proponent shall carry out the same type of analysis regarding reservoirs.

626. The Proponent shall explain plans for the construction of dikes or dredging to restrict flooding and shall present the impoundment schedule, including the uncertainty inherent in such a schedule. The possible environmental benefits of these plans shall be outlined.

627. In reservoirs, and in the Lac Bienville area in particular, the Proponent shall discuss plans to control water levels via containment measures and shall outline mitigating measures where waterfowl and other resources are vulnerable to this type of development.

628. With regard to impacts on fish and other wildlife, the Proponent shall address at least the following:

1. protection and development of aquatic habitats;
2. opening of new fishing areas;
3. formulation and evaluation of methods for implementing an intensive harvest program, prior to filling the reservoirs and forebays upstream, to enable the recovery and relocation of wildlife;
4. a comparative and detailed assessment of mitigative strategies designed to control the production of methylmercury and its bio-accumulation in fish, waterfowl and marine mammals;
5. development of spawning beds, taking into account reservoir operations and the various species concerned, specifying design and location criteria;
6. implementation of measures to allow for fish transport through the turbines and to control fish mortality;
7. formulation of a reservoir management policy designed to ensure the protection, diversity and productivity of fish stocks in the reservoirs. To this end, the Proponent shall discuss links between reservoir design and operation criteria on the one hand and fish community structures and reproductive strategies on the other; the Proponent's analysis shall

include a clear description of the constraints inherent in managing reservoirs and containment bays as well as an explanation of the areas of uncertainty that should be considered in developing these strategies;
8. establishment of an environmental studies program designed to improve the level of information available on the freshwater seal population of the Lacs des Loups Marins;
9. recovering wood debris from reservoirs; and
10. maintenance of minimum discharge.

RESTORATION AND PROJECT ADMINISTRATION

629. With regard to clean-up measures, restoration of degraded areas and resources and project administration, the Proponent shall develop strategies that address the following:

1. clean-up of sectors that could be flooded and which include waste items, particularly barrels, that could pose a threat to the environment;
2. periods when construction must be modified in order to protect fish spawning, waterfowl migration, caribou migration, etc.;
3. the proposed restoration program and the various methods available for restoring and redeveloping sites which were stripped or otherwise disturbed by construction activities;
4. if temporary roads prove necessary, the Proponent shall indicate the re-naturalization modes selected. The Proponent shall also indicate the measures to be implemented for decommissioning these roads and other infrastructures and for restoring the affected watercourses;
5. the administrative status of permanent roads, during and after construction; the Proponent shall indicate which department or organization will control and maintain these roads and control access to the territory;
6. the possibility of adjusting work schedules to accommodate traditional hunting activities, especially in Manitounuk Sound;
7. long-term responsibility for the implementation of the mitigative measures should project infrastructure or other types of equipment cease to be under the Proponent's control; and
8. clean up and renewal programs related to material and waste at the end or during the construction periods and operation.

RESIDUAL IMPACTS AND COMPENSATORY MEASURES

630. Residual impacts are those physical, social and economic impacts for which no mitigative measures can be established or that remain even after

implementation of mitigative measures, including the environmental impacts of such major installations as dams, dikes, access infrastructures, and transmission line corridors which permanently alter the natural environment.

631. The Proponent shall identify the nature and scope of all residual impacts of the proposed project regarding both the construction and operation phases of the complex, referring to the same criteria used to identify the original impacts in order to facilitate comparison between the two groups of impacts. The Proponent shall present residual impacts in the form of an overview that will enable compensatory measures to be identified.

632. There is often a fine line between mitigative and compensatory measures. Some mitigative measures identified above may also be described as compensatory measures. It shall be the Proponent's responsibility to distinguish one from the other in the presentation of the EIS.

633. The Proponent shall clearly describe its policy concerning compensating the Native population for the construction and operation of the proposed project, as well as for its impacts. The Proponent shall indicate how this policy would be applied with respect to the proposed project and in particular shall identify which persons or groups would be compensated.

634. The Proponent's policy regarding compensation for the Native population with respect to any unforeseen impacts of the proposed project discovered after mitigation and compensatory measures had already been determined shall also be indicated.

CHAPTER 7

ENVIRONMENTAL SURVEILLANCE, MONITORING, AND LONG-TERM MANAGEMENT PROGRAMS

OVERVIEW AND PRINCIPLES

701. If the project is approved and implemented,the Proponent shall be responsible for mitigating, compensating and managing any impacts that might arise. Some of these effects will have been predicted in the EIS; others may only be determined through experience. The Proponent shall thus describe how impacts will be determined, validated and responded to over successive stages of the project's implementation. Action programs shall provide for surveillance of practices and procedures during the construction phase; monitoring of biophysical, social and cultural conditions at critical stages of implementation; and long-term management of the project and its impacts throughout the life of the project.

702. The surveillance, monitoring and long-term management programs involve varying degrees of collaboration with certain agencies, organizations and authorities other than the Proponent. The Proponent shall identify the participants involved in various processes during the life of the project, the protocol and institutional frameworks necessary for their coordination, the threshold for triggering action for all monitoring requirements, and shall indicate how and by whom this action can be activated. The Proponent shall ensure that those concerned, notably the Inuit and the Cree, participate in the proposed mechanisms, and shall facilitate the circulation of collected information.

703. Actions contemplated for the operational phase of the proposed Great Whale project should be informed by and make reference to the experience gained through the La Grande project. The Proponent shall submit an assessment, along with comments from the Natives, of the environmental monitoring performed for the first phase of the La Grande complex, including an evaluation of how the results of this monitoring enhanced the understanding of the ecosystems, and how the information

produced was linked to action with respect to specific remedial or compensatory measures, and specific project management decisions.

704. Surveillance, monitoring and long-term management programs shall be designed with sufficient flexibility so they may be modified in light of new information and unforeseen events.

SURVEILLANCE

705. Environmental surveillance involves the general supervision of project construction to ensure that the conditions of authorization and all environmental laws, regulations and codes are respected.

706. The Proponent shall identify specific surveillance measures to be implemented, the environmental code to be applied, as well as the contractors' obligations arising from environment-related provisions in their contracts.

707. The Proponent shall describe the measures to be taken to ensure that on-site personnel are well-informed with respect to Native rights and traditional lifestyles.

708. A detailed description of the Proponent's operating manual shall be provided. The Proponent shall also describe in detail the process to be employed in the surveillance of activities involving the use of explosives, including the control measures designed to ensure this surveillance, the management procedures for hazardous products and waste and for fire surveillance, and the emergency intervention measures to be used during and after construction.

MONITORING

709. Environmental monitoring refers to the study of conditions both during and after construction so as to determine whether or not environmental impacts are as anticipated. The objectives of the monitoring program are to seek a better understanding of the nature of impacts; to help improve methods of anticipating the impacts of future development projects; and to assess the effectiveness of the measures and the need for changes in operating procedures. The knowledge gathered by the Proponent shall be applied to improve mitigative or compensatory

measures, operating procedures and the long-term management plan. The Proponent shall thus describe how all of the impacts predicted in response to Chapter 5 of these Guidelines, as well as any unanticipated impacts that might arise, will be monitored.

710. In addition, should the project be approved, the environmental monitoring program shall complete the gathering of the baseline data required to describe original environmental conditions and shall contribute to the study and management of cumulative impacts generated by major hydroelectric developments.

711. The proposed monitoring program shall reflect the experience gained through the La Grande projects and other comparable hydroelectric complexes and subsequent efforts to monitor their impacts. This proposal should include descriptions and, where appropriate, explanations of the changes made to the methodology used in the La Grande (1975) complex environmental monitoring program.

LONG-TERM MANAGEMENT

712. The Proponent shall indicate how the proposed project and its impacts will be managed over time; which agencies and organizations will be involved in particular processes at various times in the life span of the project; and how measures prescribed at the time of the submission of the impact study will combine with adaptive responses in the future to ensure that the project remains consistent with sustainable and equitable development efforts in the region.

713. The Proponent shall identify how the operation, utilization, development, possible rebuilding and eventual dismantling of certain installations will be handled in accordance with the needs of the Proponent, the Native people and other users of the territory. Accordingly, the Proponent shall indicate whether some of the installations, including all of the access infrastructures, may be used as they are or may be converted to other purposes, by other proponents or by the Native communities, or if they must be dismantled at the end of their useful life. The proposed means of restoration of the area that could be affected by the proposed project shall also be presented.

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